"The Applicability of the NASA Thesarus to the File of Document Issued Prior to its Publication"

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THE APPLICABILITY OF THE NASA THESAURUS TO THE FILE OF DOCUMENTS INDEXED PRIOR TO ITS PUBLICATION

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University of Pittsburgh, 1969

This study is concerned with determining the applicability of a thesaurus, the NASA Thesaurus, to a file of documents indexed, prior to its publication, by another authority list, the NASA Subject Authority List. Both lists are theoretically applicable to the same file of documents.

Determination of applicability is considered on two levels. The first analysis consists of a comparison of the terms in the two authority lists. In order to develop a set of terms of particular applicability to the Pittsburgh Regional Dissemination Center, the terms in the strategies, used for one "current awareness" search during the period the Subject Authority List was in effect, were used to develop a subset of the Thesaurus consisting of all the strategy terms as Main Terms in the Thesaurus and all the appropriate subterms. The terms in the subset of the Thesaurus were converted to the form of the term used in the Subject Authority List and an analysis made of the differences between the forms of the terms on the two authority lists.

A second part of this study considered the effect of the change in terminology upon the empirically developed strategies used to search the file during one retrospective search period.

It was concluded that although 90 per cent of the sample terms appeared on both lists, the two authority lists represented two different systems for the analysis of information. Although the Thesaurus was usable to some extent with the file indexed prior to the publication of the Thesaurus, it did not describe the retrospective file as represented by the empirically developed strategies used originally to search the retrospective file.

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THE APPLICABILITY OF THE NASA THESAURUS TO THE FILE OF DOCUMENTS INDEXED PRIOR TO ITS PUBLICATION

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CHAPTER I

INTRODUCTION

One of the basic problems in information systems is the provision of a description of the organization of the file that is adequate for the retrieval of information. One method of describing the organization of a file is through the use of a classification system whose notation provides an artificial framework within which the materials in the file can be organized. The advantage of a classification system is that some insight into its intellectual framework can be gained by an examination of the total system and the user can locate within the structure of the notation at least one aspect that may relate to his particular subject interest.

Because of the rigidity of traditional classification schemes and their inability to provide an adequate number of access points to the documents in a collection, the designers of many large information systems turned to the use of index terms for the subject analysis of materials acquired. Index terms may or may not be organized within an intellectual framework. If no control has been established and terms are used from the literature at will, no organized approach to the retrieval of information is possible. A basic form of control is stabilization of the form of the word acceptable to the system as an index term. Another elementary form of control is the development of a list of headings which can be used as index terms.

Although index terms theoretically provide multiple points of access, the disadvantage of their use is that the terms themselves have no inherent

structure which relates to the subject contents of the file and an examination of the terms may not enable the user to define the parameters of his area of interest with any degree of precision.

In order to compensate for the lack of inherent structure in a list of index terms, there has been a trend toward the development of a tool, the thesaurus, whose purpose is to display the relationships among index terms. A thesaurus may be developed in a systematic or uncontrolled way. If the information system began its operations with a thesaurus as the authority list, the term relationships may be assumed to be both prescriptive and descriptive. If the thesaurus was developed after the system became operative, how well the term relationships displayed describe the organization of the retrospective file will depend upon the extent to which this purpose governed its compilation.

The Thesaurus in Information Systems

A thesaurus has been defined as "a book containing a store of words or information about a particular field or set of concepts."[1] Some years ago it was suggested that a thesaural-like tool would be useful in information retrieval systems. The subsequent application of this name to structured lists of terms used in information systems has been traced in Cooperation, Convertibility, and Compatibility Among Information Systems; A Literature Review,[2] hereafter referred to as Cooperation.

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[1] Webster's Third New International Dictionary of the English Language Unabridged, (Springfield, Mass.: G. & C. Merriam Co., 1966), p. 2374.

[2] U. S. Department of Commerce, National Bureau of Standards Miscellaneous Publication 276, Cooperation, Convertibility, and Compatibility Among Information Systems; A Literature Review, (Washington, D. C.: Government Printing Office, 1966), pp. 67-9., (Known hereinafter as Cooperation.)

It has apparently not been possible to determine who first suggested the name "thesaurus" in connection with I. R. systems although it evidently first appeared in published form in a bulletin issued by Mooers in 1951 in which he stated that "to surmount this problem of alternative expression, there must be a word book or encyclopedic source of vocabluary having features common to a thesaurus, a dictionary, and an encyclopedia."[3]

Vickery, in 1960, in discussing the use of the term, says that "Roget's Thesaurus has two characteristics - its purpose and its form. Its purpose is to help the user to move from an idea to the word . . .. The ideas are also, of course, symbolized by words."[4] Vickery further describes Roget's Thesaurus by saying "a, it links idea-words with text-words; b, the idea-words are classified; and, c, there is an alphabetical index to all words in the schedule."[5] He says that a similar tool ". . . which links text-words to key-words, and aids the indexer to pass from texts to key-word" would be useful.[6]

Wall describes the purposes of a thesaurus "(1) to permit the indexer . . . to index (i.e., describe) more fully, and at different levels of generality and from many technical points-of-view . . . and (2) to permit the searcher for information to phrase an inquiry appropriate to the scope and degree of his immediate interests."[7] He then describes a

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[3] Cooperation, p. 68.

[4] B. C. Vickery, "Thesaurus - A New Word in Documentation," Journal of Documentation, XVI, No. 4 (1960), 182.

[5] Ibid, p. 187.

[6] Ibid, p. 185.

[7] Eugene Wall, Information Retrieval Thesauri (New York, Engineers Joint Council, November, 1962), p. 1.

thesaurus appropriate for an information retrieval system similar to thesauri now in use.

The first major government agency to publish a thesaurus for use with a major information system was the Armed Services Technical Information Agency [ASTIA,,now the Defense Documentation Center (DDC)] This agency had the responsibility for the collection, analysis and dissemination of the results of Department of Defense (DoD) sponsored research and development reports. In 1959, a decision was made to change from a manually operated subject heading method of subject analysis to a mechanized system using coordinate indexing. This major project is described in the following passage.

> The conversion from subject headings to descriptors and the reindexing of the 200,000 most recent reports were achieved as a result of ASTIA's Project MARS. In this vocabulary development, the major subject headings were divorced from their subdivisions and, in one move, the list was reduced from 70,000 combinations to about 8300 main headings. The 850 subdivisions were reduced to about 600, resulting in a vocabulary of some 9000 terms.
>
> This draft vocabulary was then edited and purified by eliminating synonomous terms and establishing appropriate cross references. Also, many of the infrequently used terms were coalesced and included in closely related terms. These actions further reduced the number of descriptors to less than 7000. Finally, the descriptors were organized into 292 groups of logically related terms and 19 subject discipline fileds designed according to a quasi-heirarchical classification system. A volume containing the descriptor groups and fields was published in May, 1960, as the "Thesaurus of ASTIA Descriptors."[8]

The Engineers Joint Council (EJC) was involved in the revision of

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[8]J. F. Caponio and T. L. Gillum, "Practical Aspects Concerning the Development and Use of ASTIA's Thesaurus in Information Retrieval," Journal of Chemical Documentation, IV, No. 5 (1964), 6.

the ASTIA thesaurus, which appeared in its second edition in 1962. At the same time the EJC, with a grant from the National Science Foundation, began a study of the existing engineering vocabulary as represented in the various engineering societies. More than one hundred thousand terms were submitted to the EJC by the different groups in the form of index terms, subject heading lists and classification schemes. A "master word list" was made up of the fourteen thousand terms submitted by more than one source. After further editing, this list was reduced to approximately eleven thousand terms. In the first edition of the EJC Thesaurus of Engineering Terms, published in 1964, they were arranged alphabetically by main term and the display indicated synonymous, hierarchical and other relationships.[9]

Although a number of thesauri were in existence before the EJC thesaurus, it has been the most influential in the later development of thesauri and is a direct progenitor of the current NASA Thesaurus.

In 1965, both the DoD and the EJC planned to revise their thesauri and recognizing the benefits that would accrue from such a stem, consolidated their efforts. This joint effort was called Projext Lex and resulted in the publication of the DDC/EJC thesaurus in 1968.

A major objective in the revision of the DDC thesaurus was that of providing an interdisciplinary thesaurus that would fulfill "the need for uniformity, both in thesaurus format and in the treatment of terms. . ."[10]

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[9]F. Y. Speight, "What Is 'The Thesaurus of Engineering Terms' Developed by Engineers' Joint Council (EJC)," Bulletin De L'Association des Documentalistes et techniciens de l'Information, V, No. 4 (1966), 32.

[10]Department of Defense, Office of Naval Research, The Making of Test Thesaurus of Engineering and Scientific Terms, Final Report of Project Lex, (November, 1967), p. 4., (Hereinafter known as The Making of Test Thesaurus).

The reason for this objective becomes clear when the development of information systems within the federal agencies is considered.

The increased involvement of the Federal government in the sponsorship of research activity following World War II and its consequent responsibility for the dissemination of scientific and technical information to business and industry led to the establishment of information systems in a number of federal agencies. Since the agencies assumed responsibility only for the report literature generated by their own research, the information systems in the various agencies developed independently. The agencies are mission oriented and therefore there is some necessary overlap in their research interests.

There has been an intensive examination of the total information network, including both the privately sponsored systems as well as those resulting from governmental activities, in an effort to create a more effective overall system for the dissemination of information in these fields. Since 1957, several different committees have been appointed and assigned the responsibility of evaluating and making recommendations for the improvement of current facilities. These analyses culminated in the report Recommendations for National Document Handling Systems in Science and Technology issued by the Committee on Scientific and Technical Information (COSATI) in 1965. The objective of this study was the design of a "national information transfer system or network of systems."[11] This report considered in detail many of the operational problems involved.

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[11]U. S. Department of Commerce, Committee on Scientific and Technical Information, Recommendations for National Document Handling Systems in Science and Technology, (November, 1965), p. 4., (Hereinafter known as Recommendations for National Document Handling Systems).

The system most strongly recommended is a decentralized one based on the existing systems with the addition of a capping agency whose primary functions would apparently be in directing policy, defining areas of responsibility, and in coordinating the whole into a massive network. One recommendation of direct interest to this study was that in the section dealing with documents, their processing and control which includes the following statement.

> Criteria, processes, and techniques should be developed for minimizing unnecessary redundancy in the system. This would include consideration of the following:
> (1) Overlap in collections.
> (2) Duplication of indexes, abstracts, and translations of the same item.
>
> With respect to processing and manipulation of documents, there is a requirement to develop standards and ensure compatibility of the various products. This includes: . . .
> (2) Compatibility of products such as indexes, catalogs, and thesauri so that the tools used by the various agencies are readily convertible.[12]

Another statement of interest to this study appeared in the section labeled "Disadvantages of the Responsible Agent System Concept."

> Vocabularies will be proliferated, making interdisciplinary communication difficult.
> Discussion. This argument has already been referred to under the discussion of advantages of the RA system, where it was pointed out that specialized vocabularies grow in size and the degree of specialization.[13]

The problem was apparently one of interagency communication. Because

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[12] Ibid, Appendix A, Section 4, p. 12.

[13] Ibid, Section 5, p. 50.

each agency's information system had developed independently, all developed different methods and terms for the subject analysis of materials acquired although all had some areas of interest in common. For example, at the time of the sample period of this study, 25 per cent of the materials acquired by the National Aeronautics and Space Administration (NASA) were acquired from the DDC and re-indexed for use in the NASA information system.[14]

Prior to the publication of Cooperation, several studies had been made that attempted to evaluate the terminology used by the DDC, the Atomic Energy Commission (AEC) and NASA in terms of convertibility and compatibility. Both terms are defined in Cooperation, "compatibility" as "systems are considered to be compatible when the results of processing in one system are immediately and directly usable by other organizations having similar but not necessarily identical systems." and "convertibility" as "where results and products of processing in one system are usable in another system, but not immediately or directly."[15]

These studies took two forms, (1) a term by term comparison in the case of the AEC and DDC terminology, and, (2) a comparison of inter-agency consistency in the use of index terms as determined by a comparison of terms assigned to a set of documents indexed by two agencies. These reports are summarized in Cooperation.[16]

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[14]National Aeronautics and Space Administration, Office of Technology Utilization, Selected Technology for the Electric Power Industry, "Information Sources and Programs" by James E. Burnett, (Washington, D. C., 1968), p. 309., (Hereinafter known as Burnett, "Information Sources").

[15]Cooperation, p. 6.

[16]Ibid, pp. 77-82.

As a result of these studies, it was apparently decided that only a "uniform" vocabulary would further the compatibility of federal information systems.

In 1968, NASA published a thesaurus for use in the NASA information system. In the introduction, the statement is made that "a high degree of term compatibility with the Project Lex vocabulary has been a major objective in the development of the NASA Thesaurus. The close coordination observed by the two projects should enhance communication . . . between the two large scientific and technical information systems that sponsored these efforts . . . ."[17]

Prior to the publication of the NASA Thesaurus, hereafter called the Thesaurus, the only authority list designed for use in the system was the Subject Authority List (SAL), an alphabetically arranged list of index terms used in the system. The Thesaurus was apparently developed to establish better control over the application of the terms, both in indexing and in the development of search strategies, by displaying the relationships among terms. The degree to which the Thesaurus utilizes the terminology available in the SAL has not been clearly stated. The only reference to earlier indexing in the Thesaurus is the statement, "the terminology of the Thesaurus is based in large part on the actual indexing vocabulary developed by NASA during the period 1962-1966."[18] A kind of presumption of identity is justifiable on the basis that both the SAL and Thesaurus are to be utilized for the same purpose, i.e., as

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[17]National Aeronautics and Space Administration, Office of Technology Utilization, NASA Thesaurus (Washington, D. C.:Government Printing Office, 1967), I, v., (Hereinafter known as NASA Thesaurus).

[18]Ibid.

a means of access to the same closed file.

The objective of this investigation is to determine the relationship between the terms in the Thesaurus and the terms in the SAL. The first part of this investigation is directed toward determining whether it is possible to develop a small number of rules whose application will enable the analyst to translate a strategy designed for searching the current file into terminology compatible with the retrospective file without constant referral to the SAL for verification of a term.

A second analysis relevant to the usefulness of the Thesaurus for retrospective searches is concerned with the relationship between the "Use" reference and the referred-to (Used For) term. The deleted term and its legal referent may have been either synonymous, i.e., they appeared separately but within the same indexing contexts, or redundant, i.e., the co-occurred frequently in indexes to documents.

One of the primary concerns of this study is the degree of correlation possible when two authority lists have been developed and both are theoretically applicable to the same set of documents. To some extent, this information could have been obtained by matching the terms in the Thesaurus and SAL. This method would have required a complete census and a comparison of all of the terms on the two lists and would not have reflected the use of the terms in an operating system.

The importance of two classes of terms, the access entries and the deleted terms, to the file of documents indexed during the period the SAL was in effect was determined in part by the use of those classes of terms in an information system.

The Knowledge Availability Systems Center (KASC), while acting as a Regional Dissemination Center (RDC) for NASA, accumulated a large body

of information related to the retrieval of information from the NASA file. This information was used as the data base for this investigation.

The Data Base

The KAS Center made available the raw material for this project: the data from one "current awareness" search period antedating the publication of the Thesaurus. This consists of

1. the strategies used
2. the list of document accession numbers cited by the strategy as a result of the computer search of the sample period.
3. The analyst's prediction of the relevancy of the citations based on the abstract of the document.

The abstracts judged relevant by the analyst were forwarded to the user who, in some cases, returned a relevancy sheet to the system. The sample of strategies used in this investigation was limited to those for which there were two levels of relevancy evaluation available, the analyst's and the user's.

The Strategies.- Strategies consist of terms and connectors arranged in various configurations. Any term appearing in the authority list as a legal term may be used in a strategy. An example of one of the least complex strategies is the following:

TEMPERATURE MEASUREMENT + THERMISTOR

The plus sign (+) represented "and/or." This strategy would retrieve all documents indexed by either Temperature Measurement or Thermistor. Terms connected by a plus sign (+) are referred to as a "union" of terms.

The search program in use at the KAS Center permits the use of one other connector, an asterisk (*). If the preceding strategy has included an asterisk in place of the plus sign, only those documents indexed by both terms would have been retrieved. Terms connected by an asterisk are referred to as an "intersection" of terms.

The Differences Between the Terms in the Two Authority Lists

NASA has recommended that the strategies initially be written to conform to the form of the term found in the Thesaurus, in order to take advantage of the display of terms in the Thesaurus, and then converted to a form suitable for searching the SAL. One of the objectives of this study is a comparison of the two sets of terms, those in the Thesaurus with those in the SAL, in order to determine whether any rules can be developed that will permit the conversion of the terms used in the strategies designed for the Thesaurus file to terms suitable for searching the SAL file.

The terms in the strategies were in the form found in the SAL because the sample period antedated the publication of the Thesaurus. In order to generate a set of terms related to those used in the strategies at the KAS Center, the terms in the strategies were equated with the form of the term found in the Thesaurus. For example, the term

THERMISTOR

in the strategy discussed in the preceding section appears as

THERMISTORS

in the Thesaurus. Other differences between the two sets of terms are less straightforward. For example, the SAL term

ABLATING MATERIAL

appears in the Thesaurus as

ABLATIVE MATERIALS

This set of Thesaurus terms was used to create a subset of the Thesaurus that included the strategy term in the form found in the Thesaurus and all of the subterms appearing under the term as a Main Term in the Thesaurus. The terms in this subset of the Thesaurus were then converted to the form of the term found in the SAL. The final result of this exercise was an authority list using the form of the term found in the SAL arranged in the structure employed in the Thesaurus. This SAL/Thesaurus was used as an authority list for this study. Its development was necessary to insure that the term equivalencies were made and used consistently throughout the investigation.

CHAPTER II

THE NASA INFORMATION SYSTEM

The National Aeronautics and Space Administration has developed a mission oriented information system that attempts to collect comprehensively in the field of aerospace science. It is required by statute to make appropriate dissemination of the information collected.[19]

This responsibility is discharged in part by the publication of two major announcement journals, a number of continuing bibliographies, other non-recurring brief announcements and the creation of a machine readable tape which includes bibliographic information and a subject analysis of the documents acquired by NASA. Both the published materials and the machine readable tape are available at the central facility and are also distributed to seven Regional Dissemination Centers throughout the country. A schematic of the system appears as Figure 1, page 15.

The NASA Collection

Approximately eight thousand documents are added during each search period to the NASA collection which now includes more than seven hundred thousand documents.[20] Part of this is report literature generated both by NASA contractors and by other government agencies whose reports are screened by NASA for material of interest to the aerospace community.

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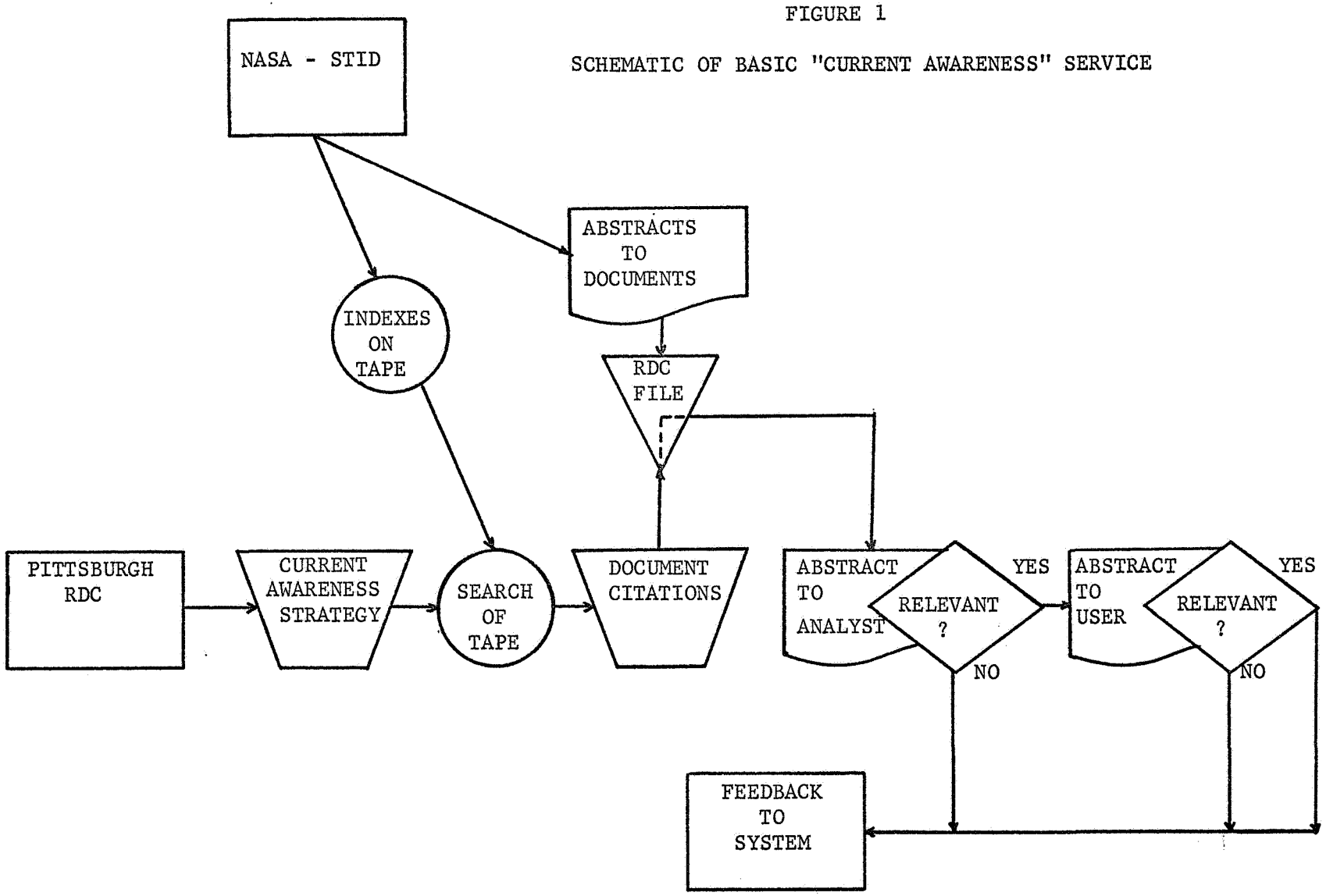
[19] Recommendations for National Document Handling Systems, Appendix A, A Background Study, Section 9, p. 22.

[20] Burnett, "Information Sources and Programs," p. 309.

FIGURE 1

SCHEMATIC OF BASIC "CURRENT AWARENESS" SERVICE



The Announcement Journals

The report literature is announced in the indexing and abstracting journal, Scientific and Technical Aerospace Reports (STAR). Reports classified for reasons of security are indexed and abstracted in CSTAR. The published literature in the aerospace field is announced in another journal, issued in the same format as STAR, International Aerospace Abstracts (IAA). There is no overlap in the coverage of these two journals. STAR includes only the report literature and IAA, the published literature of the field. The documents included in STAR are assigned an accession number beginning with an "N" and those in IAA, an accession number beginning with an "A." Both are issued bi-weekly but on such a schedule that they appear on alternate weeks.

The Subject Analysis

The documents, both the report and the published literature, are channeled to a contractor for processing. At the time of the sample period used in this study, the organization was Documentation, Inc. In 1962, Documentation, Inc., under a contract with the NASA Scientific and Technical Information Division (STID), began operation of the NASA Scientific and Technical Information Facility (STIF). Since 1963, when NASA began to support, partially, the Technical Information Service of the American Institute of Aeronautics and Astronautics (AIAA), the subject analysis of the published literature has been handled in the same way as the report literature.

Each document received by NASA receives a bibliographic description and a subject analysis of its contents. This subject analysis consists of

1. the assignment of the category number under which the abstract of the document will appear in the published journals. The categories have been described as "34 subject categories (now 35) covering eight disciplines, eighteen different areas of engineering, and two interdisciplinary categories. Few of the categories are mutually exclusive."[21]
2. an abstract of the document.
3. a "notation of contents" which can be described as an expanded title.
4. three to five index terms assigned for use in the announcement journals.
5. additional index terms assigned for use on the machine readable tape.

At the time of the sample period, the average number of index terms assigned per document was seventeen.[22]

STAR and IAA are divided into three main sections. Part one includes abstracts of all the documents acquired since the publication of the previous issue arranged by accession number under their assigned category. The second section consists of an alphabetically arranged list of index terms under which are recorded the accession numbers of the documents indexed by that term, the notation of contents, and a reference to the category number assigned to the document. The third section includes an

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[21] Recommendations for National Document Handling Systems, Appendix A, A Background Study, Section 6, p. 84.

[22] This figure is generated by the reformatting program used at the Pittsburgh RDC and does not agree with the figure used in the introduction to the SAL.

index to the corporate sources responsible for documents in that issue and to the document accession numbers in that issue, including the original accession number assigned by another agency to a document NASA has acquired, with a reference to the NASA accession number.

The "Current Awareness" Tape

Each machine readable tape received from NASA represents one "current awareness" search period and corresponds to two issues each of STAR and IAA. The tape, as it is issued by NASA, includes the unique accession number assigned to each document, the category number to which it was assigned, the notation of contents, and the index terms assigned, both those included for use in the announcement journals and the additional terms usable only in a computer search of the tape.

In addition to the "A" and "N" document accession numbers representing the report and journal literature in the field, a third set of document indexes is included on the current awareness tape. These accession numbers, the A80,000 series, represent a continuing bibliography of aerospace medicine compiled by the Library of Congress. This series has not been considered in the study because the documents in this series are not available in the same way that "A" and "N" documents are available. The "N" documents, the report literature, are sent to the Regional Dissemination Centers in the form of microfiche and are available immediately to the users in hard copy if, after reading an abstract of the document, the user is interested in acquiring the entire document. The "A" documents, because they are open or journal literature, constitute a copyright problem and are not as rapidly available to the user as are the "N" documents. When an "A" document is ordered, the journal

in which it appeared is borrowed, the article is copied, and the copy forwarded to the user. The A80,000 series is not available through the NASA system.

The Regional Dissemination Centers

Although the functions of acquisition and analysis of material are performed centrally, STID has followed a policy of decentralization for the searching, retrieval and provision of hard copy functions.

Regional Dissemination Centers were established as part of the NASA decentralization program designed to assure rapid and flexible service for the users of the system. The Regional Dissemination Centers are supplied by NASA with a "current awareness" tape in the format previously described. A microfiche copy of the reports abstracted in STAR from which hard copies can be made is also supplied by NASA, as well as abstracts of the "A" and "N" documents in hard copy. The articles abstracted in IAA are available only in the journals and are not supplied by NASA but copies of these articles are disseminated by the Pittsburgh RDC.

The Pittsburgh Regional Dissemination Center

The University of Pittsburgh, in 1963, created the Knowledge Availability Systems Center whose objective was to develop a program of research and teaching in the information sciences. In 1964, the University proposed to NASA that the KAS Center be made a center for the dissemination of aerospace information to local business and industry. The proposal was accepted and since 1964, the KAS Center has acted as a Regional Dissemination Center under a contract with NASA.

The NASA RDC at the University of Pittsburgh provides a "current awareness" service for users of the system consisting of a computer search

of the tape issued at the end of each four week period by NASA. Questions are submitted to the system by users who subscribe to the service on an annual basis. At the time of the sample period, subscribers were charged a flat fee for which they were permitted to submit a fixed number of question statements to the system.

These question statements are converted into strategies suitable for searching the computer file. The strategies are re-used each period for a search of the "current awareness" tape. Searches of the retrospective file are also possible and are often requested by the user when a new question statement is submitted to the system.

The result of the computer search of the tape consists of a list of document accession numbers whose indexes fulfilled the requirements of the strategy.

The Function of the Analysts

In order to exploit most effectively the NASA files for the benefit of the subscribers, a group of intermediaries, the analysts, are interposed between the file and the users. The analysts at the Pittsburgh RDC are subject specialists whose function is to

1. analyze the question statement submitted by the user.
2. translate it into a strategy for searching the machine readable file.
3. evaluate the documents retrieved by the computer search in terms of the question statement submitted by the user.

These recurring question statements that are searched during each "current awareness" period are assigned to specific analysts, usually on the basis of their subject competence. The abstracts for the computer cited

documents are clerically retrieved and sent to the appropriate analyst for his evaluation of their relevance to the user's question statement. The abstracts for the documents he considers relevant are forwarded to the user with an "evaluation sheet" on which the user is asked to note his evaluation of the "relatedness" of the document to his question. The evaluation sheet consists of the list of accession numbers of the documents judged relevant, on the basis of the abstract, by the analyst. The first column following the accession number is reserved for ordering the document. The second column is labeled "Related", the third column is labeled "Not Related - Keep Sending" and the fourth column, "Not-Related - Stop Sending".

Only part of the users return evaluation sheets during any one search period.

Information from two sources is useful to the analyst, information from the user as to the relevance of the forwarded documents to the user's question statement and information from the system as to the terms in the strategy that retrieved relevant documents. Although the schematic shows that information from some users concerning the relevance of the forwarded documents filters back into the system, there is usually a considerable lapse of time before this occurs.

At the time of the sample period, the only way the analyst could get any information concerning the effectiveness of the terms in the strategies was by examining a printout of the index terms on the "current awareness" tape and checking the terms assigned to the relevant documents against the terms in the strategies.

The Program at the Pittsburgh Regional Dissemination Center

The Pittsburgh RDC strips from the NASA tape the document accession number, category number and index terms and reformats this information in order to perform the computer search more economically. The search program used at the Pittsubrgh RDC precludes the use of some of the search techniques possible at the central facility and some Regional Dissemination Centers, e.g., negation, weighting of terms, or searching for any item except category number or index term.

CHAPTER III

THE TWO AUTHORITY LISTS

The major point of access to the NASA file is through the subject analysis of the documents. Because of the size of the file and the rate at which documents are being acquired, access is almost limited to a mechanized search. Knowledge of the organization of the file can only be gained empirically unless the terms used for the subject analysis are presented in a form that represents the organization of the file. Although in the introduction to the Thesaurus, the following statements appear, "the NASA Thesaurus is an alphabetical listing of terms by which the documents in the NASA scientific and technical information system are indexed and retrieved." and "the terminology of the Thesaurus is based in large part on the actual indexing vocabulary developed by NASA during the period 1962-1966,"[23] the degree to which the terms in the Thesaurus are usable with the retrospective file is unknown. This chapter consists of a description of the structure of the two authority lists.

The Subject Authority List

Prior to the publication of the Thesaurus, the only authority list developed for use with the NASA information system was the Subject Authority List (SAL). This was an alphabetically arranged list of index terms coded to show their use in the system, i.e., all legal terms could be

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[23] NASA Thesaurus, Vol. I, p. v.

used on the machine readable tape but not all terms could be used in the published announcement journals. For example, some terms, such as

FLOW

were not considered specific enough for use in the published indexes. Term fragments, such as

ELECTRIC

were not used in the published indexes. The frequency with which each term had been used in either the published journals or on the machine readable tape was also indicated. A new issue of the SAL was published quarterly. One page of the SAL appears as Figure 2.

The Thesaurus

The Thesaurus consists of three volumes. The first two volumes utilize the structure common to such authority lists. One page of the Thesaurus appears as Figure 3. Each term appears once as a Main Term in the alphabetic sequence. Under each Main Term is a list of subterms arranged alphabetically within categories, "Used For" entries, "Broader" terms, "Narrower" terms, and "Related" terms. The "Used For" entries are access entries, i.e., terms not legal within the system that refer to legal terms. For example, listed under the Main Term

CLOCKS

in the Thesaurus, are the following categories of subterms:

Used For	WATCHES
Broader Terms	MEASURING INSTRUMENTS
	TIME MEASURING INSTRUMENTS
Narrower Terms	ATOMIC CLOCKS
	CHRONOMETERS
	CLOCK PARADOX
Related Terms	TIME MEASUREMENT
	TIMING DEVICES

SUBJECT AUTHORITY LIST, AS OF JUNE 12, 1967

TYPE	POST.	ALPHA TERM	PUB	MACH	62-4	65-A	-N	-X	66-A	-N	-X	67-A	-N	-X	TOTAL
3		CERENKOV EFFECT	19	7	11	2	1		2	4		3	3		26
3		CERENKOV RADIATION	136	47	51	35	14	3	38	12	4	13	8	5	183
1	1	CERES		8	3	1	2			1	1				8
3		CERES ASTEROID	2				1	1							2
3		CERESIN	3	1	1			1			2				4
3		CERIUM	69	219	89	14	61	11	7	63	15	5	21	2	288
3		CERIUM COMPOUND	39		10	6	6	3	2	6	2	2	2		39
3		CERIUM 137	2	2	2			1					1		4
3		CERIUM 144	13	17	16		2	5		4	1		2		30
3		CERMET	124	183	75	11	25	36	28	48	28	11	29	16	307
1	1	CERTIFICATION		17	2	3	2		2	3	3		1	1	17
3		CESIUM	362	1566	637	157	249	105	191	195	123	91	133	47	1928
3		CESIUM ANTIMONIDE	4		1	1			1				1		4
3		CESIUM BROMIDE	6		3	1				1			1		6
3		CESIUM COMPOUND	28		11	1	3	1	1	2	2		4	3	28
3		CESIUM DIODE	53		17	9	3	1	13	3	4	2	1		53
3		CESIUM ENGINE	56		26	6	3	1	12	2		5	1		56
3		CESIUM FLUORIDE	15		1	1	1	2	2	4	2	1	1		15
3		CESIUM HALIDE	5		2		1			2					5
3		CESIUM HYDRIDE	4		4										4
3		CESIUM IODIDE	4			1	1	1		1					4
3		CESIUM ION	129		52	17	13	3	18	6	3	8	8	1	129
3		CESIUM OXIDE	7				2	1		2	1		1		7
3		CESIUM PLASMA	172		50	31	12	4	37	11	3	19	2	3	172
3		CESIUM VAPOR	157		59	18	22	4	22	9	2	14	7		157
3		CESIUM 125	1										1		1
3		CESIUM 127	1										1		1
3		CESIUM 134	3	3	1		2			1		1	1		6
3		CESIUM 136	1										1		1
3		CESIUM 137	55	66	23	1	16			29	7	1	41	3	121
3		CESIUM 144		5	3					2					5
1	1	CESSNA L-19 AIRCRAFT		2	1			1							2
3	1	CESSNA MILITARY AIRCRAFT		1			1								1
3		CESSNA 172 AIRCRAFT	1		1										1
3		CESSNA 205 AIRCRAFT	1		1										1
3		CESSNA 210 AIRCRAFT	2		1				1						2
3		CESSNA 336 AIRCRAFT	2	1	2							1			3
1	1	CETANE		6	1	3	1		1						6
1	1	CETYL		4	1					3					4

The Subject Authority List

Figure 2

```
      #COATINGS
       INORGANIC COATINGS
       PROTECTIVE COATINGS
  RT   FINISHES
       METAL COATINGS
       PORCELAIN
       SPRAYED COATINGS
       VACUUM DEPOSITION
CERAMIC HONEYCOMBS
   1801 3202
  BT   CERAMICS
  RT   HONEYCOMB CORES
       HONEYCOMB STRUCTURES
CERAMIC NUCLEAR FUELS
   1801 2203
  BT   CERAMICS
      #FUELS
       NUCLEAR FUELS
  RT   CARBIDES
       CERMETS
       NITRIDES
       PLUTONIUM COMPOUNDS
       PLUTONIUM OXIDES
       THORIUM COMPOUNDS
       URANIUM CARBIDES
       URANIUM COMPOUNDS
       URANIUM OXIDES
CERAMICS
   1801
  NT   CERAMIC BONDING
       CERAMIC COATINGS
       CERAMIC HONEYCOMBS
       CERAMIC NUCLEAR FUELS
       PORCELAIN
       PYROCERAM (TRADEMARK)
  RT   ABRASIVES
       BAKELITE (TRADEMARK)
       BRICKS
       CERMETS
       CLAYS
       DIELECTRICS
       FRIT
       GLASS
       GLAZES
       MASONRY
       MATERIALS SCIENCE
       MORTARS (MATERIAL)
       PYROLYTIC MATERIALS
       REFRACTORIES
      #REFRACTORY MATERIALS
       SILICON DIOXIDE
       TILES
CERCOCEBUS MONKEYS
   0402
  BT  #ANIMALS
       MAMMALS
       MONKEYS
       PRIMATES
       VERTEBRATES
CEREBELLUM
   0404
  BT  #ANATOMY
       BRAIN
       CENTRAL NERVOUS SYSTEM
      #NERVOUS SYSTEM
CEREBRAL CORTEX
   0404
  BT  #ANATOMY
       BRAIN
       CENTRAL NERVOUS SYSTEM
      #NERVOUS SYSTEM
  RT   CORTEXES
CEREBRAL VASCULAR ACCIDENTS
   0402 0405
  RT   CARDIOVASCULAR SYSTEM
       STROKES
CEREBROSPINAL FLUID
   0403 0404
  BT  #BODY FLUIDS
  RT   BRAIN
       FLUIDS
CEREBRUM
   0404
  BT  #ANATOMY
       BONES
CERENKOV COUNTERS
   1406
  BT   COUNTERS
      #MEASURING INSTRUMENTS
       RADIATION COUNTERS
       RADIATION MEASURING INSTRUMENTS
  RT   CERENKOV RADIATION
       SCINTILLATION COUNTERS
CERENKOV EFFECT
  USE  CERENKOV RADIATION
CERENKOV RADIATION
   0710 2310 2402 2403
  UF   CERENKOV EFFECT
  BT  #ELECTROMAGNETIC RADIATION
  RT   BREMSSTRAHLUNG
       CERENKOV COUNTERS
       CORPUSCULAR RADIATION
       COSMIC RAYS
       GAMMA RAYS
       LIGHT (VISIBLE RADIATION)
       NUCLEAR RADIATION
       ULTRAVIOLET RADIATION
CERES ASTEROID
   3001 3008
  BT   ASTEROIDS
      #CELESTIAL BODIES
CERESIN
   1806 1808
  BT  #ALIPHATIC COMPOUNDS
       ALKANES
      #HYDROCARBONS
       PARAFFINS
       WAXES
CERIUM
   0603 1703
  BT  #CHEMICAL ELEMENTS
      #METALS
       RARE EARTH ELEMENTS
  NT   CERIUM ISOTOPES
       CERIUM 137
       CERIUM 144
CERIUM COMPOUNDS
   0603 1804
  BT  #RARE EARTH COMPOUNDS
  NT   BASTNASITE
  RT   METAL COMPOUNDS
CERIUM ISOTOPES
   0603 1703 2406
  BT   CERIUM
      #CHEMICAL ELEMENTS
       ISOTOPES
      #METALS
       NUCLIDES
       RARE EARTH ELEMENTS
  NT   CERIUM 137
       CERIUM 144
CERIUM 137
   0603 1703 2406
  BT   CERIUM
       CERIUM ISOTOPES
      #CHEMICAL ELEMENTS
       ISOTOPES
      #METALS
       NUCLIDES
       RADIOACTIVE ISOTOPES
       RARE EARTH ELEMENTS
CERIUM 144
   0603 2406
  BT   CERIUM
       CERIUM ISOTOPES
      #CHEMICAL ELEMENTS
       ISOTOPES
      #METALS
       NUCLIDES
       RADIOACTIVE ISOTOPES
       RARE EARTH ELEMENTS
CERMETS
   1701 1801 3305
  UF   CERAMAL PROTECTIVE COATINGS
       CERAMALS
  BT  #COMPOSITE MATERIALS
  RT   CERAMIC NUCLEAR FUELS
       CERAMICS
       HEAT RESISTANT ALLOYS
       POWDER METALLURGY
```

The Thesaurus

Figure 3

The first term

WATCHES

is not a legal entry and the user is told to use

CLOCKS

instead. The remaining terms are legal terms in the system and bear some relationship to the Main Term.

In the preceding example, that in which the "Use" reference is to one legal term, it may be assumed that within the system, the two terms are synonymous. In other cases, the access entry refers to two or more legal terms. For example, the access entry

INSTRUMENTAL ANALYSIS

has a "Use" reference to both

ANALYZING and AUTOMATION.

Clearly, in this case, the terms are not synonymous to the same degree. Access term "A" cannot replace two legal terms, "B" and "C" because this places "B" and "C" in an anomalous position. The reference must mean that "A" is a subset of "B" and/or "C" but not necessarily an intersection of "B" and "C".

The Array Term.- In addition to the explicit access entry mentioned above, there is an implicit access entry represented by the "Array Term." These are terms, evidently so ambiguous and ubiquitous in the system, that the use of another term has been recommended in their stead, although they are legal entries. These terms do not belong to hierarchies but bear only "Related Term" relationships with other terms. There are several kinds of ambiguity that account for different kinds of Array Terms. In some cases the Array Term has formed the head of the construction for several unrelated multiple word terms. Among these terms there may be only the most tenuous of relationships.

The assignment of terms of this kind to the category of Array Terms is at least partly the effect of exploding multiple word terms into their component parts with the result that the word has so many referents that it has lost any value it has originally as an index term. In other cases, the ambiguity apparently results from the inclusion of terms within the system whose referent may be either a concrete object or a quality or characteristic by which objects or processes may be described.

In addition to appearing in a single version with directions to use another term, if possible, the Array Term serves another purpose in the Thesaurus, i.e., that of directing the user to several forms of the word each with different referents. For example, another kind of Array Term is represented by the Array Term

BEARING

which also appears in two other forms

BEARING (DIRECTION)
BEARINGS

There is no ambiguity when the term is glossed or defined by subterms as

it is in the Thesaurus. However, appearing in only one form and undefined as it does in the SAL, the term could have been applied to these and other referents.

The Categories.- Following each legal main term is the number of the subcategory or subcategories to which it has been assigned. Originally, the categories were developed for use in the printed indexes in which each document was assigned a two digit number representing one of the categories used by the NASA system. Each category assignment appeared in the published indexes and on the machine readable tape. In Appendix B, Volume III, in the Thesaurus, each category, now thirty-five in number, has been fragmented into a number of subcategories represented by a four digit number in which the first two digits represent the category and the second two, the subcategory. Each category and subcategory is named and the name sometimes also appears as an index term. It is not known whether the two, category or subcategory, and name are co-extensive. Each category is defined and a reference made to related categories.

Volume III of the Thesaurus.- Appendix A, Volume III, is a display of all the hierarchies culled from the "Broader" and "Narrower" term relationships indicated in the first two volumes. Any term may belong to more than one hierarchy or to none. Levels in the hierarchy are indicated by indentations. The greatest number of levels appears to be five. Implicit in the category and subcategory arrangement is a three level hierarchy. The relationship between these two separate hierarchies has not been stated.

Appendix C, Volume III, is an index in which each word that appears as part of a multiple word term is arranged in alphabetical order and

followed by the list of terms in which it appears.

Appendix D, Volume III, is an alphabetically arranged list of the legal terms and the final authority list as to their punctuation, spacing, etc.

The two main volumes and the Appendices in Volume III permit access to the index terms in a number of different ways:

1. in an alphabetical list followed and defined by subterms.
2. displayed as part of hierarchy if the term belongs to one of the hierarchical structures.
3. as a term in a category and subcategory.
4. with other terms that include the same word.

The Function of a Thesaurus

The indexing system as revealed in the Thesaurus apparently attempts to name those aspects of documents that might be of interest to the users of the file. The whole construction of the Thesaurus is focused upon the elimination of ambiguity in the application of terms. Indexing languages parallel natural language but they are not the same as natural language. The major difference is that the referent of a word used in natural language is delimited by the context in which it is used. The elimination of ambiguity in the Thesaurus is attempted and to some degree accomplished in several ways, all of which are an attempt to provide context.

1. the subject areas covered in an information system delimit the context of a term. For example, the term

   EGO

   clearly has one referent in the area of psychology and another in the NASA file.

2. a second way of providing context for a term is the method used in thesauri and frequently in dictionaries, by listing with the word other words that are, to some degree, synonymous.
3. a third way of eliminating ambiguity is by use of the gloss. Two glosses are used in this way in the Thesaurus, those that indicate either the field or the context of the term.
4. a fourth way of providing context is by use of a suffix that will enable the user to discriminate between two forms of the word. Use of this technique is possible only when rules have been established which the user recognizes concerning the use of suffixes.
5. by defining the term in a scope note.

CHAPTER IV

THE EXPERIMENTAL DATA BASE

For the single "current awareness" search period selected as the data base for this investigation, the indexes to 5600 "A" and "N" documents were added to the machine searchable file and more than eight hundred question statements were searched as part of the "current awareness" service of the NASA Regional Dissemination Center at the University of Pittsburgh.

Since the usefulness of the Thesaurus would be determined in part by the user's evaluation of the cited documents, only those strategies for which this information was available were used. A second delimitation was that the question statement be represented by a unique search strategy. Almost two hundred of the question statements submitted to the system were not assigned unique strategies but were searched with similar question statements. These were not included in the sample. Approximately 7 per cent of the strategies searched retrieve document citations infrequently, primarily because their subject area is not one covered to any great extent in the aerospace literature. In the Fourth Annual Report made to NASA by the Space and Technology Transfer Program at the University of Pittsburgh, "no citation" strategies were attributed to "three possible causes:

1. The phrased profile may be extremely narrow and specific
2. Abstract journal coverage of subject areas may be cyclic in nature.

3. Search strategies may be inadequate."[24]

In a further discussion of the "no citation" strategies, it is suggested that, in certain subject areas, the yield is small because of the limited amount of research being done in that area. The cyclic phenomenon is partially the result of the periodicity of journal publication and the publication of the papers of conferences devoted to one subject area. The third factor contributing to the "no citation" strategies, i.e., those for which no documents were cited by the computer search, may be the result of inadequate use of applicable terminology.[25] The statement is made that poor indexing may also be a factor controlling retrieval and that "a major factor contributing to inadequate indexing is the time lag between the creation and the adoption of a newly formulated technical term."[26] For this investigation, those strategies for which no documents were cited as a result of the computer search and those for which none of the cited documents were forwarded to the user by the analyst were excluded from the sample. Because it was believed that it would be useful to compare the strategies developed after the publication of the Thesaurus with those in use before its effective date, strategies that were cancelled prior to January 31, 1968 were also eliminated from the sample.

Here, in summary, are the criteria used to select the sample of strategies forming the data base for this study, 1) the strategy must have

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[24]University of Pittsburgh, Knowledge Availability Systems Center, Fourth Annual Report, (1968), p. 28, (Hereinafter referred to as KASC, Fourth Annual Report).

[25]Ibid, p. 31.

[26]Ibid.

been applicable to only one question statement; 2) the computer search must have resulted in citations some or all of which were judged relevant by the analyst and forwarded to the user; 3) the user must have returned a relevance sheet indicating the "relatedness" of the computer cited documents to his question statement, and 4) the question must still have been in force after the effective date of the Thesaurus. The chart in Figure 4, page 35, illustrates these delimitations.

Each question statement received by the Regional Dissemination Center at the University of Pittsburgh is kept in a separate folder labeled with a unique number. All questions received and searched are maintained in strict confidence. The unique number is provided as a means of removing any meaningful designation from the folder regarding the company or individual served. The computer printout of the documents cited as a result of the computer search of the file, the analyst's evaluation of the documents cited, and the user's evaluation if any has been received, are all kept in the folder with any other information pertinent to the question statement. In order to select the strategies meeting the previously established criteria, the contents of the folders for each question statement had to be investigated by KAS Center staff and the strategy developed from the question statement either added to the sample or eliminated because it failed to meet the criteria.

The following analysis of the question statements in effect during the sample period and the reason for their elimination from the sample is illustrated in Figure 4, page 35, and summarized in Figure 5, page 37.

Although more than eight hundred strategies were searched during the sample period, only seven hundred and thirty-five were reserved for further consideration. Eliminated were those strategies developed for questions

AN ANALYSIS OF THE "CURRENT AWARENESS" STRATEGIES (CAS) SEARCHED DURING ONE SEARCH PERIOD

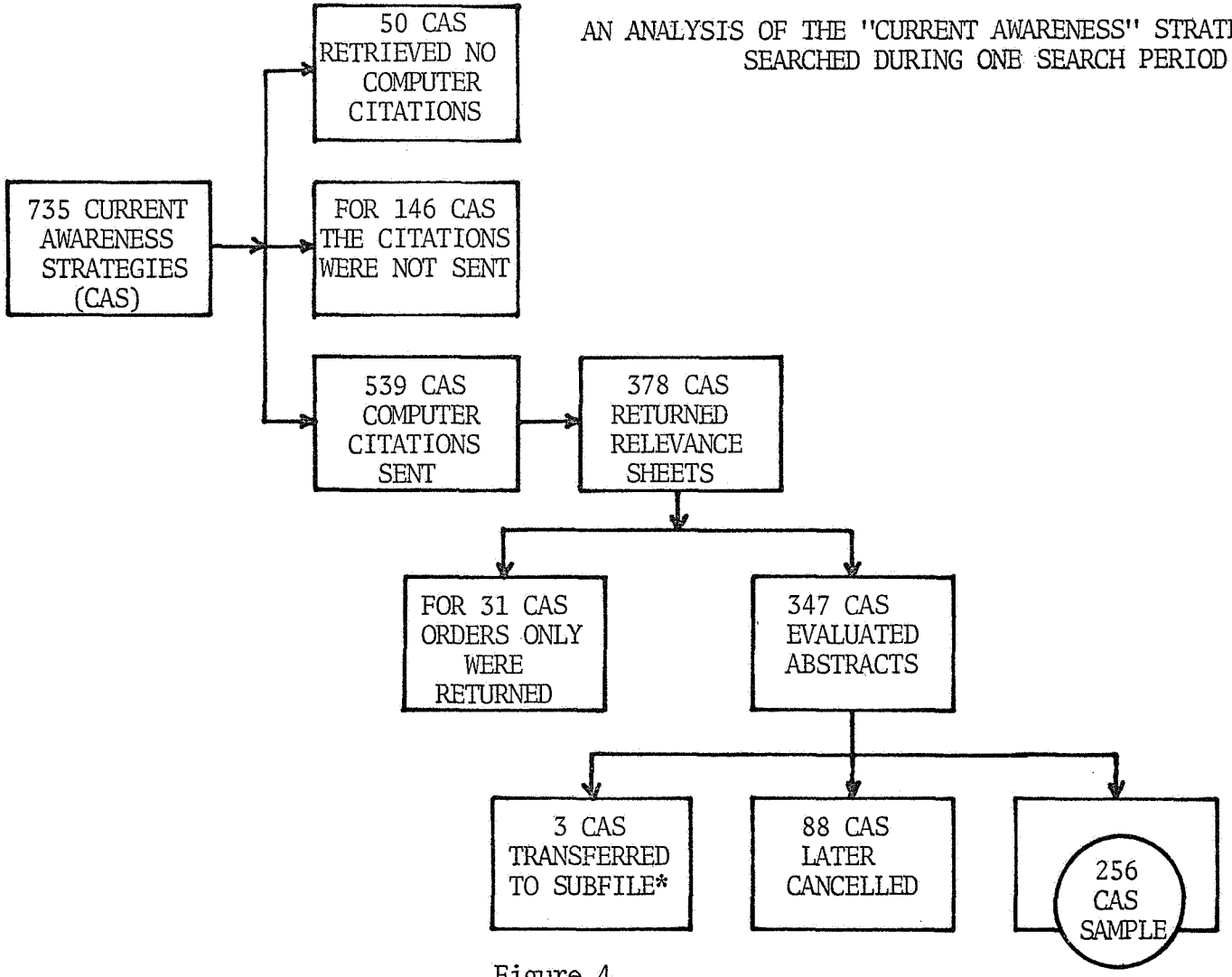


Figure 4

* Searched with similar questions.

The letters preceding the following paragraphs refer to appropriate sections of Figure 5.

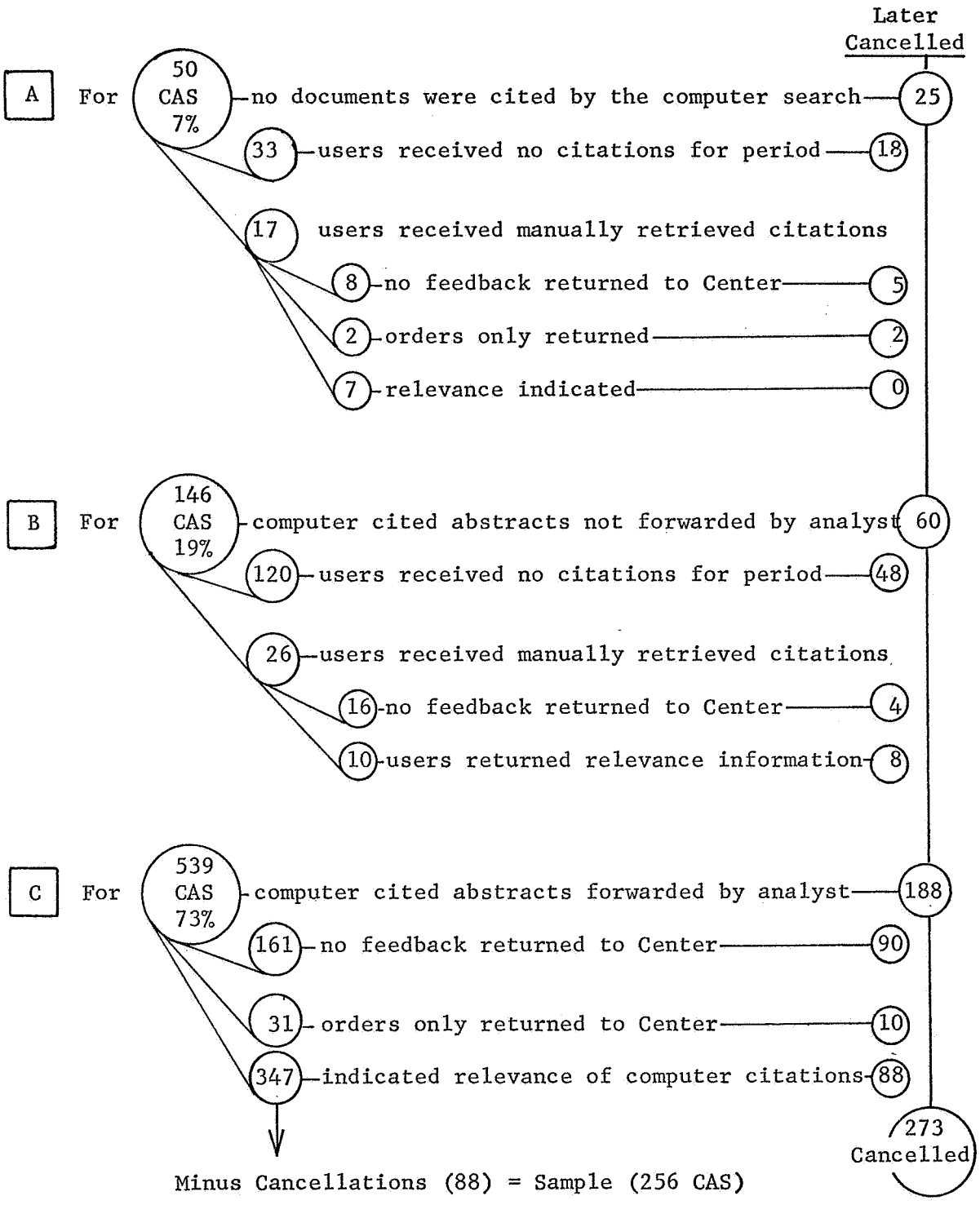
A For 50 of the 735 strategies, almost 7 per cent, no documents were cited as a result of the computer search. For 17 in this group of 50, a total of 31 abstracts were manually retrieved by the analyst and forwarded to the user, 9 of whom returned relevance sheets to the Center. Two of the relevance sheets comprised only orders for documents. Two of those returning relevance information later cancelled their questions.

B Although the computer search resulted in document citations for the 146 strategies in this category, 19 per cent of the total number of strategies searched, the computer-cited abstracts were judged not relevant by the analyst and were not forwarded to the user. For 26 question statements in this group, abstracts were manually retrieved by the analyst and forwarded to the user. Twelve of those receiving document citations returned relevance sheets to the Center, 6 of whom later cancelled their questions. Four of the 14 who received abstracts but did not return relevance sheets later cancelled their questions.

The remaining 120 users of the "current awareness" service in this category, 16 per cent of the total number of users, received no abstracts for this period. Of this group, 48 later cancelled their questions.

C The remaining 539 strategies, 73 per cent of the total number searched, retrieved document citations as a result of the computer search, some or all of which were judged relevant by the analyst and forwarded to the user. In this category, 375, almost 70 per cent of those receiving computer-cited document abstracts, returned relevance sheets to the Center. Thirty-one responses consisted of document orders with no indication of the relevance of the abstracts forwarded. These strategies were eliminated from the sample as were the 161 strategies for which no relevance sheets were received from the users. Of the remaining 344 question statements, 88 were later cancelled and 3 were transferred to subfiles, i.e., searched with similar question statements.

The remaining 256 strategies, 33 per cent of the total number of "current awareness" strategies searched, met the previously established criteria and constituted the sample strategies for this study.



A BREAKDOWN OF THE 735 "CURRENT AWARENESS" STRATEGIES (CAS) SEARCHED DURING THE SAMPLE PERIOD

Figure 5

cancelled prior to the sample period, during the sample period, or during the "current awareness" period immediately following. Also eliminated were a very small number of strategies for which information for the period was incomplete.

Description of the Strategies

The strategies can be sorted into three categories, as shown in Figure 6.

1 The single aspect and union strategies

The least complicated strategy consists of either a single term or a series of single terms summed. The union is represented in the examples by a plus sign (+). When this type of strategy is used, it may be assumed that, in the opinion of the analyst, the terms represent the question statement, or some aspect of the question statement, and that every document indexed by the term has the possibility of being relevant to the question statement. The following are examples of strategies in this category.

VACUUM DEPOSITION
TEMPERATURE MEASUREMENT + THERMISTOR

In the 256 strategies used for this study, there were thirteen (5 per cent) consisting of a single term and sixty-eight (26 per cent) consisting of a series of two or more terms summed.

2 The intersection

A second category includes those strategies based on an intersection of terms, represented in the sample by an asterisk (*). Apparently in these cases, no single term represents the question statement and the analyst is interested in documents indexed by term "A" only if they are also indexed by term "B." The simplest strategy of this type consists of the intersection of two terms, for example,

THE STRATEGIES: CATEGORIZED BY TYPE OF STRATEGY

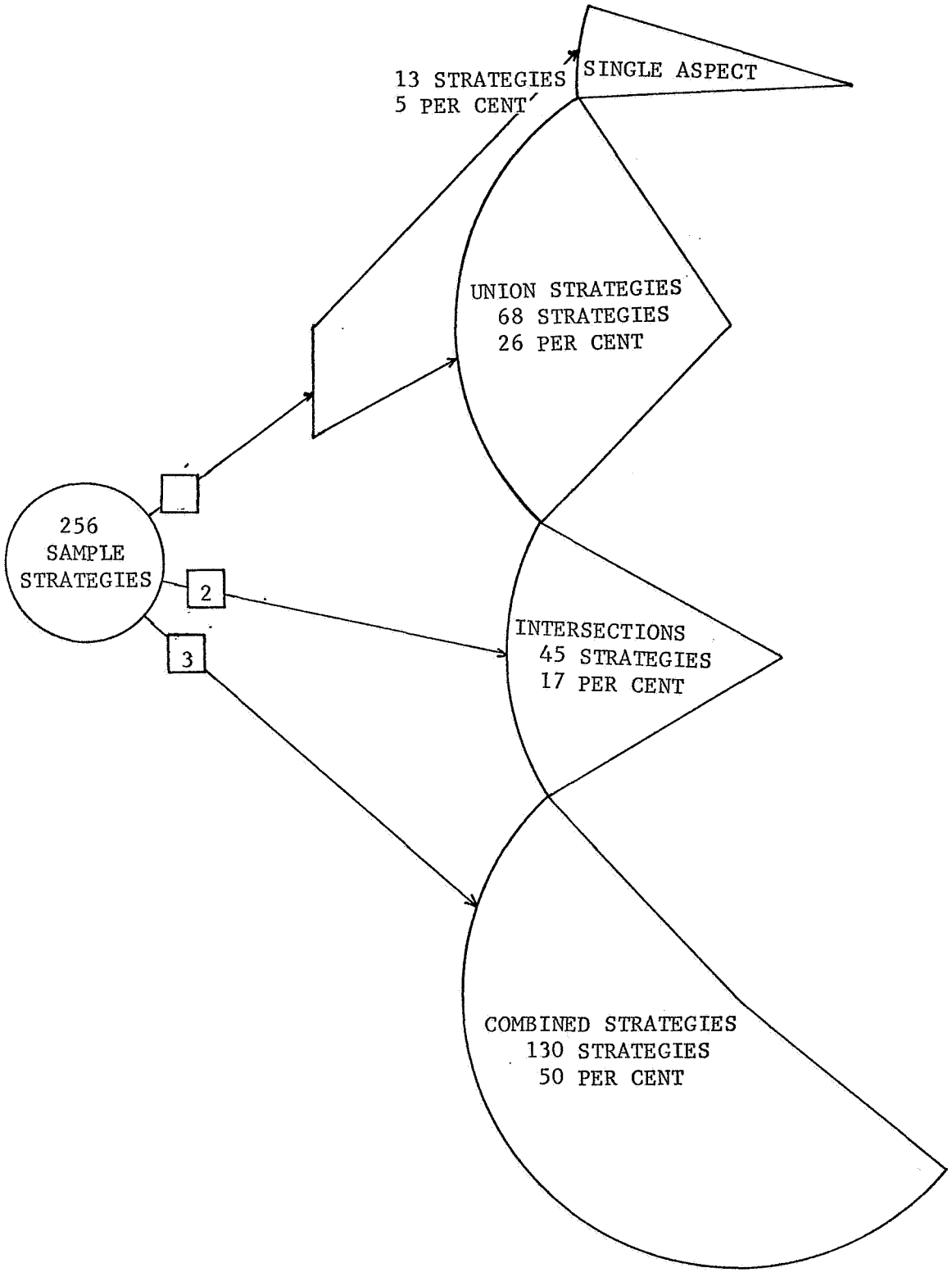


Figure 6

OXIDATION * METAL.

There were two such strategies in the sample. This type of strategy most closely approximates the classic uniterm strategy in which two, three or four very broad terms, i.e., terms with non-specific referents, were joined in an intersection to retrieve document citations of a highly specific nature. Taube and Wachtel use, as an example, the coordination of the terms PLASTICS, BONDING, METAL and WOOD to find references to "plastics bonding metal to wood."[27]

More complex forms in this category of strategies are the following configurations which represent a series of intersections summed. There were eleven strategies similar to the following configuration.

HYDROCARBON*(CATALYTIC ACTIVITY+CATALYSIS+CATALYST)

The following example is a variation of the preceeding form. There were twenty-two strategies in the sample of this type.

[(RADAR+ANTENNA)*(ARRAY+PHASED ARRAY)]

A still more complex variation is the following configuration which consists of two or more parts. Each part of the strategy includes one or more intersections summed.

[FUSELAGE*(HELICOPTER+VIBRATION)]+(HELICOPTER*VIBRATION)

Forty-five strategies, or approximately 17 per cent of the sample of two hundred and fifty-six strategies, belonged to the second category, "Intersections."

3 The combined strategy

The third category consists of strategies in which one or more terms

---

[27]Mortimer Taube and Associates, Studies in Coordinate Indexing, (n.p.:Documentation, Inc., 1953), p. 39.

and one or more intersections are summed. There are one hundred and thirty such strategies in the sample.

Example

ADHESIVE+(ADHESION*POLYMER)

More then 50 per cent of the strategies in the sample fit this configuration or some variation of this configuration.

The reasons for the development of such a strategy become clear when the system as a whole is considered. The NASA system of indexing was never a "pure" uniterm system. There was always some provision made for the use of multiple-word, or precoordinated terms that were used to index the documents in the published indexes. This is explained in a discussion of the NASA system by Van A. Wente,

> The NASA system designers recognized at the outset that these two approaches to retrieval, book indexes and tape files, may best employ two different types of indexing. It was felt that if the two types of indexing could be performed simultaneously and without duplication of effort, a significant gain in efficiency would be realized. On the one hand, the manipulative nature of computer type data allowed the use of term coordination of an almost unlimited degree. On the other hand, printed indexes, because of their nonmanipulative nature, required the use of a *subject heading* type of indexing, whereby a highly developed structure of terms and cross-references guides the searcher to relatively more specific terms in the indexes where he might look for desired subject matter. In actual practice, the difference between these two indexing approaches became a difference in degree of what may be called *precoordination*.
>
> A completely word-by-word approach to indexing for computer retrieval may result in an extensive potential for false combinations and lack of specificity. Therefore, a machine vocabulary was developed which required precoordinations of those words most likely to give such results if used by themselves: proper names, specific things or projects and certain very general terms (LOW, HIGH, etc.) A vocabulary of approximately 13,000 terms resulted with about 40 per cent of its terms precoordinated. From 15 to 20 or

> more of these terms are currently employed to characterize the average document in the tape data.[28]

Each document acquired by NASA was, at the time of the sample period, assigned an average of three published terms and "10 machine terms," i.e., terms that were never used in the published indexes.[29]

The NASA system imposed a double burden on the analyst or user of the system in that he not only had to predict which term or terms might have been assigned to a document, he then had to be able to predict the form in which the term would appear, i.e., in an intact form as used in the published indexes or in the exploded form used on the machine readable tape. If a multiple word term had been used to index the document in the published indexes, it would appear on the machine readable tape in the same form. In order to make the system consistent with uniterm principles, there was, at least part of the time, a policy that required that the multiple word terms be fragmented into their component parts for use on the machine readable tape.

In Indexing Guidelines for Use with the NASA Thesaurus, the following statement appears in the section labeled "Changes in Indexing Practices/ Patterns"

> The unitizing (breaking down) of combined (precoordinated) published terms into machine retrieval terms will be discontinued.
>
> For example, LIQUID PROPELLANT ROCKET ENGINE (Old Subject Guide Term)
> LIQUID; PROPELLANT; ROCKET ENGINE or

---

[28]Van A. Wente, "Specificity and Accessibility in a System of Information Centers on Space and Aeronautics," Colloquium on Technical Preconditions for Retrieval Center Operations, ed. Benjamin F. Cheydleur (N. Y.: Macmillan, 1965), p. 56.

[29]This figure appears in the SAL in the Introduction and does not agree with the figure generated by the program used at the KAS Center.

ROCKET and ENGINE (Machine Retrieval Terms)

> The Thesaurus will contain a modified version of most old "uniterms." These will be used based on the information being indexed and not automatically upposted as previously.[30]

Apparently "upposting" meant exploding the multiple word terms into their component parts.

This practice was evidently never firmly established as policy because it varied from time to time, and when it was in effect, was not consistently enforced. Therefore, Documentation, Inc., recommended that all strategies include both forms of the term, the exploded form because the document may not have appeared under the intact form in the published indexes because it was not a "major concept" in the document, and the intact form because if the document had been indexed under the intact form in the published indexes, the term may not have been exploded for use on the machine readable tape.[31]

As a result, analysts tended to reinforce their strategies by including both forms of the term. There are four strategies in the "combined" category in which the multiple word term is used as a single term and its component parts are used in an intersection. For example

ELECTRIC MOTOR + (ELECTRIC * MOTOR)

Many of the combined strategies include a pattern of this sort.

However, in developing the list of terms used in the sample

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[30]National Aeronautics and Space Administration, "Indexing Guidelines for Use with the NASA Thesaurus," Unpublished paper, January, 1968.

[31]Documentation Incorporated, Guide to the Processing, Storage, and Retrieval of Bibliographic Information at the NASA Scientific and Technical Information Facility, (College Part, Md., 1966), pp. 8-9.

strategies, no attempt was made to equate the terms forming intersections with a precoordinated form including both terms. A casual examination of the strategies will show that although some of the strategies include an intersection made up of two parts of a multiple word term included in the SAL and sometimes in the strategies in an intact form, many of the terms forming intersections are not represented in the SAL in a multiple word form.

Some strategies seem to include both possibilities, that is, 1) the use of two terms to form an intersection not provided for in the terminology, and 2) to back up a multiple word term also used in an intact form in the strategy.

The median number of documents retrieved by the sample strategies was 20.5. The number of documents retrieved by individual strategies ranged from one document (by eight strategies) to two hundred and seventy-six documents (one strategy). Approximately one-third of the strategies retrieved eleven or fewer documents.

The median number of documents judged relevant by the analyst was five. The number of documents judged relevant for the individual strategies ranged from one (for forty-two strategies) to two hundred and forty-two (one strategy). For more than one-third of the strategies, the analyst judged three or fewer documents relevant.

CHAPTER V

THE TERMS IN THE STRATEGIES

The preceding chapter described the strategies which were used to generate a set of terms of particular applicability to the subject areas searched at the Pittsburgh RDC. The terms from the strategies were in the form found in the SAL because the sample period antedated the publication of the Thesaurus. This chapter consists of a discussion of the problems involved in finding the equivalent Thesaurus forms of the terms when starting with the SAL forms. The succeeding chapter discusses the conversion process from the opposite position, i.e., finding the equivalent SAL term when beginning with the Thesaurus form of the term.

It was necessary to convert the SAL terms to the forms found in the Thesaurus because the strategy terms were to be used to develop a subset of the Thesaurus. This subset consisted of the strategy terms as Main Terms in the Thesaurus and all of their appropriate subterms. For example, one of the terms appearing in the strategies was

BRASS

which appears in the Thesaurus as

BRASSES

with the following subterms:

Broader Terms	ALLOYS
	COPPER ALLOYS

In order to generate a set of terms related to the subject areas

searched at the KAS Center, all of the subterms appearing under

BRASSES

as a Main Term in the Thesaurus were needed to form a subset of the Thesaurus.

Because the KAS Center had a copy of the Thesaurus on computer tape, the process of selecting the subterms could be accomplished mechanically after the strategy terms were equated with Thesaurus terms. The mechanics of the computer processing that was needed is explained in Appendix A. However, a brief summary of the process will be given whenever necessary for clarification.

The Pittsburgh Regional Dissemination Center assigns a unique five digit number to each question statement. This number is also used to identify the strategy based on the question statement. The terms, still in the SAL form as they appeared in the original strategies, were keypunched, one term per card. The number identifying the strategy in which the term appeared was keypunched on the same card. This resulted in a deck of 2,174 cards. The deck was sorted alphabetically and listed.

Because some of the terms were used in more than one strategy, another deck was keypunched consisting of the unique terms and their frequency of use in the strategies. This deck was listed. A copy of one page of this list appears as Figure 7. This list consisted of the 1,384 unique terms appearing in the strategies.

ANALOG SIMULATION	01	2	1
ANALOG COMPUTER	01	2	2
ANALYSIS	03	1	4
ANEMOMETER	01	1	2
ANEMOMETRY	01	1	4
ANTENNA	01	1	2
ANTIFRICTION	01	1	7
APPARATUS	03	1	4
APPLICATION	04	1	4
ARC	01	1	2
ARRAY	02	1	2
ATMOSPHERE	02	1	2
AUDIO	02	1	7
AUDIO EQUIPMENT	01	2	1
AUSFORMING	02	1	1
AUSTENITE	01	1	1
AUSTENITIC STEEL	02	2	3
AUTOMATION	01	1	1
AVALANCHE	01	1	2
AVIATION	01	1	4
AVIONICS	01	1	1
BACTERIA	01	1	1
BAINITE	01	1	1
BAINITIC STEEL	01	2	1
BALL BEARING	02	2	2
BARRIER	01	1	2
BARRIER LAYER	01	2	2
BATTERY	02	1	4
BAYESIAN STATISTICS	03	2	4
BEAM	01	1	2
BEARING	06	1	1
BIMETALLIC	01	1	3
BINDER	02	1	7
BIOINSTRUMENTATION	01	1	1
BLADE	01	1	2
BOILING	01	1	1
BOLT	01	1	2
BONDING	04	1	1

Figure 7

The terms from the strategies can be sorted into five categories.

1. those that did not appear in the SAL.
2. those that exactly matched a Thesaurus Term.
3. those that were the singular form of the Thesaurus plural term.
4. those that differed from the Thesaurus form in some way other than or in addition to number.
5. those for which no equivalent term could be found in the Thesaurus.

The data in the following discussion appear in tabular form in Table 1.

The terms were first checked against the SAL appropriate for the sample period. Twelve terms were not in the SAL. Some were obvious keypunching errors, for example, "Cermaic" for "Ceramic."

The following terms in the strategies did not appear in the SAL appropriate for the sample period:

AIRPLANE PRODUCTION COST
ALUMINA
CERMAIC
FLUID TRANSMISSION
METAL FINISHING
METAL FORGING
METAL GRINDING
MONITORING SYSTEM
ROCKET PROPELLANT
SYSTEM ANALYSIS
SYSTEM DESIGN
WELD

The remaining 1,373 terms were then checked against the Thesaurus and some rules for equating the form of the term in the SAL with the form in the Thesaurus tentatively established.

THE EFFECT OF CONVERTING THE STRATEGY TERMS FROM THE SAL FORM TO THE FORM FOUND IN THE THESAURUS

Number of Unique Terms		Frequency of Use in the Strategies
Terms not in the SAL	12	13
Exactly Matching Terms	606 (43.8%)	1043 (45.7%)
Legal Terms	495	855
Access Terms	111	188
Terms in Singular - Plural Configuration	530 (38.3%)	867 (38%)
Legal Terms	465	765
Access Terms	65	102
Terms Matching on Other Basis	103 (7.5%)	144 (6.3%)
Legal Terms	93	134
Access Terms	10	10
Unmatched SAL Terms	131 (9.6%)	211 (9.3%)
Total	1382	2278
Matched Terms		
Legal Terms	1251	1754
Access Terms	186 (13.5%)	300 (13.1%)
Total	1337	2054

Table 1

An attempt was made to assign term equivalencies on a one-to-one basis. When the term appeared in the same form on both lists, it was called an exact match. For example, the term

ABLATION

is the same in both the SAL and Thesaurus. There were 495 terms, 35.9 per cent, from the strategies that were the same in the SAL and Thesaurus. An additional 465 terms, 33.5 per cent, appearing in the singular in the SAL, were found in the plural in the Thesaurus.

Frequently the terms from the two lists neither matched exactly nor were they in a singular/plural relationship but were considered equivalent in the sense that both could be applied to the same referent. For example, the SAL term

ALLOTROPISM

does not appear in the Thesaurus. The most closely related term in the Thesaurus is

ALLOTROPY.

The assumption was made that the subject areas covered in the NASA file remained the same and that the documents indexed prior to the publication of the Thesaurus did not differ in content from those indexed after the publication of the Thesaurus. Therefore, the document searched for by

ALLOTROPISM

prior to the publication of the Thesaurus would have to be searched for by

ALLOTROPY

after the publication of the Thesaurus. Because only one form of the term appeared in each of the two authority lists, the terms were considered equivalent in that both terms referred to only one set of documents.

Many of the terms differed from the SAL form in number as well as by

some other modification. For example, the SAL term

FLOW METER

appears in the Thesaurus as

FLOWMETERS.

There is a difference in spacing between the two forms as well as a difference in number.

There were ninety-three strategy terms, 6.5 per cent of the total number of terms, that differed from the Thesaurus terms in some way other than solely by number. The differences between the two sets of terms involved suffixes, spacing, hyphenation, orthography, and glosses.

The terms

ALLOTROPISM and ALLOTROPY

illustrate a difference in suffixes. The terms

FLOW METER and FLOWMETERS

are illustrative of a difference in spacing. The SAL term

X-RAY

appears in the Thesaurus in an unhyphenated form,

X RAY.

The following terms are examples of a difference in orthography.
The SAL term

STRAIN GAUGE

appears in the Thesaurus as

STRAIN GAGES.

There are several ways in which the two sets of terms differ in the use of gloss. The basic difference is in the formation of the gloss. In the SAL, the gloss is bound by slashes and, in the Thesaurus, by parentheses, i.e.,

JUPITER /PLANET/
JUPITER (PLANET).

In some cases, the SAL term includes a gloss and the Thesaurus form does not, as, for example, in the SAL term

ALTERNATING CURRENT /AC/

which appears in the Thesaurus as

ALTERNATING CURRENT.

More frequently, the Thesaurus form of the term is glossed and the SAL term is not, e.g., the SAL term

TEFLON

which appears in the Thesaurus as

TEFLON (TRADEMARK).

These are the differences that appeared most frequently in equating the two sets of terms in this category. These differences and additional ones that either did not appear in this sample or appeared as unique examples are fully discussed in the following chapter.

The Access Entries

There were 186 terms, 13.5 per cent of the total number of terms, that appeared in the Thesaurus as access entries with a reference to the legal term. The relationship between the SAL term and the form of the access entry can be categorized in the same way as can those between the SAL term and the legal Thesaurus term, i.e., as exact matches, as a singular/plural relationship or as a difference that involved more than a change in number.

The Problems in Equating Terms

There were a number of problems involved in equating the SAL terms

with terms in the Thesaurus. Not all of these problems were apparent when the strategy terms were searched for in the Thesaurus because the original set of terms was so small that no clear pattern for equating terms emerged. The result was that a number of changes had to be made after the subset of the Thesaurus had been developed.

One major problem in equating the two sets of terms was that there was not a one-to-one relationship between the terms in the SAL and the terms in the Thesaurus. A second problem was that no clear line could be drawn between those terms in the sample for which equivalent terms could be assigned from the Thesaurus and those for which equivalent terms could not be assigned.

The primary objective for this part of the term conversion process, i.e., assigning equivalent Thesaurus terms for a set of terms from the SAL, was the development of a subset of the Thesaurus, not the establishment of rules for assigning term equivalencies. The reason for this is that, ordinarily, finding equivalent terms is important only when starting with a set of Thesaurus terms, for example, those in a strategy, and converting the terms in that strategy to a form usable with that part of the retrospective file indexed during the period the SAL was in effect.

The only rule necessary during this part of the term conversion process was one that would permit a two-part division of the SAL terms, those for which equivalent terms from the Thesaurus could be assigned and those for which no assignment was possible. Any inconsistencies in the assignment of equivalent terms would become apparent during the reconversion process, i.e., in finding equivalent terms in the SAL for the Main Terms and subterms that appeared in the subset of the Thesaurus. Therefore, in this part of the conversion process, no attempt was made to

assign the SAL term to only one Thesaurus term. For example, the SAL term

COATING

may be represented by either of the two Thesaurus forms,

COATING or COATINGS.

Therefore, both terms were selected as equivalent to the SAL term.

In other cases, it was possible to determine the appropriate term from the context of the strategy. For example, the SAL term

BEARING

appears in the Thesaurus in three forms,

BEARING [an array term]
BEARING (DIRECTION)
BEARINGS.

The complete strategy provided enough context to assure the selection of the correct form.

However, an attempt was made to avoid assigning more than one SAL term to a Thesaurus term. For example, although the SAL includes

VOLT and VOLTAGE

as terms, the Thesaurus includes only

VOLTAGE.

In this case, only the exactly matching terms were equated. In other cases, when there was only one form of the term in the SAL and one form in the Thesaurus, the two terms were equated. For example, the SAL term

CORD

was equated with the Thesaurus term

CORDAGE

because each authority list included only one form of the term.

The preceding examples illustrate the problems found when attempting to match terms from the SAL and Thesaurus on a one-to-one basis.

The Unmatched Terms

There were 133 terms in the sample, 9.6 per cent of the total sample, for which no equivalent Thesaurus term could be assigned. The unequated terms can be sorted into two categories. The first category includes those terms that apparently do not differ in construction from forms acceptable in the Thesaurus as index terms. For example, for the SAL term

AIR CARGO HANDLING

the most closely related Thesaurus term was

AIR CARGO.

The two terms were not equated.

The second set of SAL terms for which equivalent terms from the Thesaurus could not be found were those terms that appear in the SAL as both separate terms and as part of multiple word terms but appear in the Thesaurus only as part of a multiple word term. For example, the term

ELECTRIC

appears in the SAL as a separate term and as part of a number of multiple word terms. When the terms from the strategies were keypunched, no attempt had been made to equate terms of this nature that appeared in the strategies, frequently as part of an intersection, with multiple word terms. Although the terms forming intersections in the strategies could frequently be represented by a multiple word term, this was not always the case. Just as frequently, the intersections were not represented by any single term in the vocabulary. In any case, the anomalies of the indexing would have negated such an effort because their effect is that AB does not necessarily equal A times B.

These anomalies resulted from the attempt to provide terms for use in the published indexes and the machine readable tape simultaneously.

The multiple word terms used for the published indexes were exploded into their component parts for use on the machine readable tape. However, this was not done consistently. Because the terms used in the published indexes were also available on the computer tape, the strategies were designed to retrieve documents no matter how they were indexed, i.e., by the multiple word term or by its component parts.

The decision was made to consider all modifying words or phrases as unmatched. Most of these terms also appear in the SAL as part of multiple word terms. However, some of the terms appear as part of only one multiple word term and these terms might well have been equated with the multiple word term in which they appear, except that there is no assurance that the single word terms have been used only in the context provided by the multiple word term. For example, the SAL term

BREADBOARD

appears only in

BREADBOARD MODELS

in the Thesaurus; the term

NYLON

only in

NYLON RESINS.

Two of the remaining terms

FACE and LIP

appeared in the Thesaurus were glossed in a way that was inconsistent with the context of the strategy, i.e.,

FACE (ANATOMY)
LIPS (ANATOMY).

A Summary of the First Term Conversion Process

Most of the terms from the strategies, almost 90 per cent, exactly matched a Thesaurus term, were the singular form of the Thesaurus plural form, or differed in some way other than simply by number from the Thesaurus form of the term.

Less than 10 per cent of the strategy terms were not matched with a Thesaurus term. There were thirty-one terms in the category of unmatched terms that were similar in construction to terms acceptable in the system as index terms. Almost all of the remaining terms, when they appeared in the Thesaurus, appeared as part of multiple word terms or suffixed so that they were in the form of a noun. In some cases, both forms appeared in the SAL, i.e., the unmatched specifier and the multiple word term, as, for example,

NONDESTRUCTIVE and NONDESTRUCTIVE TESTING.

Both forms appear in the SAL, but only one form,

NONDESTRUCTIVE TESTS

appears in the Thesaurus. Both of the following terms, i.e., the unmatched spedifier and the noun form, appear in the SAL,

CERAMIC AND CERAMICS

but only one form,

CERAMICS

appears in the Thesaurus as a separate term.

In other cases, only one form appears in the SAL, for example

FRINGE

for which the most closely related term in the Thesaurus is

FRINGE PATTERNS,

or, for example the SAL term

EUTECTIC

for which the most closely related term in the Thesaurus is

EUTECTICS.

Neither

FRINGE PATTERNS or EUTECTICS

appear in the SAL.

An arbitrary decision was made to consider as unmatched all SAL terms which had either typical adjectival suffixes or appeared only as specifiers in the Thesaurus. Some exceptions to this rule were made in the second term conversion process when the Thesaurus terms were converted to the SAL form. The qualifying word "only" is important because many of the single word terms, which were matched with Thesaurus forms, also appear as part of multiple word terms in both the SAL and Thesaurus. For example, the term

VACUUM DEPOSITION

appears in both authority lists as do its component parts,

VACUUM and DEPOSITION.

Had the adjective form of

VACUUM

been "Vacual", an analogy with "Residuum" and "Residual", it would have been possible to discriminate between the two uses of the term in the system. Because the noun form is used as both a single word term and as the specifier in a multiple word term, it is not possible to determine the number of times the term's use is the result of exploding the multiple word term.

Therefore, the terms may be considered to have been equated on a mechanical basis rather than on any logical basis related to their use in

the system.

The main objective in equating SAL terms in the strategies with Thesaurus terms was not the establishment of a set of rules for equating terms but the development of a subset of the Thesaurus that would be applicable to the subject areas searched at the Pittsburgh RDC. A number of changes in both the matched and unmatched sets of terms were made as a result of the second term conversion process.

CHAPTER VI

THE CONVERSION OF THESAURUS TERMS

A Summary of the Process

In the preceding chapter, the process of converting a set of SAL terms to the form found in the Thesaurus has been described. The SAL terms were derived from strategies used at the Pittsburgh RDC during one retrospective "current awareness" search period. These terms, after having been converted to the Thesaurus form of the term, were used to create a subset of the Thesaurus consisting of each strategy term as a Main Term in the Thesaurus and all of its subterms. The computer programming necessary for this process is described in Appendix A.

More than 90 per cent of the strategy terms had been equated with a Thesaurus term. The equivalent Thesaurus forms of the terms were keypunched. This deck consisted of approximately 1500 unique terms. This subset of terms did not exactly match the set of strategy terms previously discussed. In addition to those terms in strategies for which relevance information had been returned by the user, the terms in all the strategies for which there was any feedback from the user relating to computer-cited documents were included. Some of the strategies originally included were later deleted because they did not meet the criteria for inclusion. Relevance sheets for several strategies had not been returned by the users at the time the search was made of the file for the sample of strategies. The terms from these strategies were later added to the sample but do not appear in the subsequent analysis of SAL and Thesaurus terminology.

This deck of 1500 terms was used to read from a computer tape of the Thesaurus onto another tape, all of the strategy terms in the form in which they appeared in the Thesaurus as Main Terms and all of their subterms. This process is explained in greater detail in Appendix A.

The terms in the subset of the Thesaurus were alphabetized and listed. There were approximately 22,000 terms on the list. A copy of one page of this list appears as Figure 8. Most of the terms occurred more than once on the list so that the list represents approximately 8,000 legal terms. The access entries were counted separately and are discussed later in this section.

The terms were in the form found in the Thesaurus. The objective of this part of the process was to convert the terms to the form of term used in the SAL. The final objective was the development of an SAL/Thesaurus in which the terms, in the form found in the SAL, were arranged in the structure of the Thesaurus. In order to perform this process by computer, it was necessary, whenever there was a difference in form between the Thesaurus form and the SAL term, to keypunch both terms on one machine readable card. The Thesaurus form of the term was keypunched in the first forty columns of the card and the equivalent SAL term in the second forty columns of the card.

This deck was used to convert the terms in the subset of the Thesaurus from the Thesaurus form of the term to the SAL form.

There were two kinds of terms for which there were no cards in the conversion deck. It had been unnecessary to keypunch a card for those terms that were the same in the Thesaurus and SAL. Therefore there were no conversion cards for these terms.

Because of the way that the subset of the Thesaurus was compiled, only the access entries referring to terms that appeared as Main Terms in the subset of the Thesaurus were included in the subset of the Thesaurus. Therefore, all of the terms appearing on the alphabetized list were checked against the published Thesaurus and a separate deck consisting of access entries was keypunched. Figure 8, page 63, is a copy of one page of the alphabetized list. The terms are in the form found in the Thesaurus. The term

BOUGUER LAW

is a legal term in both authority lists. Listed under this term as a "Used For" entry in the published Thesaurus is

LAMBERT LAW

which does not appear on the alphabetized list because the legal entry

BOUGUER LAW

does not appear as a Main Term in the subset of the Thesaurus.

However, the access entry

BOUNDARY LAYER NOISE

does appear in the alphabetized list because the legal entries to which it refers

AERODYNAMIC NOISE and BOUNDARY LAYERS

both appear as Main Terms in the subset of the Thesaurus.

Altogether, there were 1,712 legal entries in the subset of the Thesaurus for which there were "Use" references from 2,238 access entries. There is not a one-to-one relationship between the legal terms and the access entries because many of the legal entries refer to more than one access entry and many of the access entries refer to more than one legal term.

BOUNDARY LAYER NOISE

```
00152026        BORON 10
00049826        BORON ALLOYS
00152061        BORON CARBIDES
00175966        BORON CARBIDES
00212216        BORON CHLORIDES
00563106        BORON CHLORIDES
00053225        BORON COMPOUNDS
00151585        BORON COMPOUNDS
00152085        BORON COMPOUNDS
00152795        BORON COMPOUNDS
00152845        BORON COMPOUNDS
00493566        BORON FLUORIDES
00563116        BORON FLUORIDES
00053235        BORON HYDRIDES
00152016        BORON ISOTOPES
00152771        BORON NITRIDES
00868426        BORON NITRIDES
00152821        BORON OXIDES
00921166        BORON OXIDES
00151971        BORON
00542946        BOROSILICATE GLASS
00579776        BO P-31C HELICOPTER
01291906        BO P-31C HELICOPTER
00935416        BOSONS
00261877        BOTTLES
01278587        BOTTLES
00394147        BOUGUER LAW
01284277        BOUGUER LAW
00292196        BOULES
01195867        BOULES
00529835        BOUNDARIES
00547615        BOUNDARIES
00648167        BOUNDARIES
00678795        BOUNDARIES
00153761        BOUNDARY LAYER COMBUSTION
00238656        BOUNDARY LAYER COMBUSTION
00475607        BOUNDARY LAYER COMBUSTION
00154217        BOUNDARY LAYER CONTROL
00154767        BOUNDARY LAYER CONTROL
00155087        BOUNDARY LAYER CONTROL
00264797        BOUNDARY LAYER CONTROL
00489237        BOUNDARY LAYER CONTROL
01290017        BOUNDARY LAYER CONTROL
01293087        BOUNDARY LAYER CONTROL
00154111        BOUNDARY LAYER FLOW
00154777        BOUNDARY LAYER FLOW
00490186        BOUNDARY LAYER FLOW
00021884        BOUNDARY LAYER NOISE
00155014        BOUNDARY LAYER NOISE
00154156        BOUNDARY LAYER SEPARATION
00490196        BOUNDARY LAYER SEPARATION
01170787        BOUNDARY LAYER SEPARATION
00154227        BOUNDARY LAYER STABILITY
00154661        BOUNDARY LAYER STABILITY
```

Alphabetized List of the Terms in the Thesaurus

Figure 8

is an example of the latter configuration in that it refers the user to both

AERODYNAMIC NOISE and BOUNDARY LAYERS.

As an example of the former configuration, the legal term

ACOUSTIC MEASUREMENT

has a "Use" reference from two terms,

NOISE MEASUREMENT and SOUND MEASUREMENT.

Because the difference between the access entry and the SAL form of the term could be categorized in the same way as the difference between the legal term and the SAL form, the access entries have been included in the tables of term changes. However, the access entries have been marked with an asterisk (*) to distinguish them from the legal entries.

After the computer processing was completed, the cards used for the conversion process were manually sorted into categories based upon the difference between the two forms of the term. These categories were similar to those used during the conversion of the strategy terms from the SAL to the Thesaurus form,

1. those terms in the SAL and Thesaurus that were exact matches.
2. those terms that were plural in the Thesaurus and singular in the SAL.
3. those for which the difference between forms was other than simply a difference in number.
4. those terms in the subset of the Thesaurus for which there was no equivalent SAL term.

This information appears in tabular form in Table 2, page 65.

THE EFFECT OF CONVERTING TERMS FROM THE THESAURUS FORM TO THE SAL FORM OF THE TERM

THE RELATIONSHIPS BETWEEN THE TERMS	LEGAL TERMS	ACCESS TERMS	TOTALS
TERMS IN THE TWO SETS THAT EXACTLY MATCHED	3416 (43.4%)	994 (44%)	4410 (44%)
TERMS IN A SINGULAR/PLURAL RELATIONSHIP	2826 (36%)	735 (33%)	3561 (35%)
TERMS DIFFERING IN SOME WAY OTHER THAN BY NUMBER	723 (9.2%)	292 (13%)	1015 (10%)
THESAURUS TERMS UNMATCHED IN THE SAL	899 (11.4%)	232 (10%)	1131 (11%)
	7864 (78% of sample)	2253 (22% of sample)	10,117

Table 2

The Construction of Terms in the Thesaurus

Although NASA has never issued a separate specific statement concerning the construction of the Thesaurus, in the Introduction, Volume I, the following statement appears, ". . . the general approach followed in developing a vocabulary has been based in considerable degree on the Manual for Building a Technical Thesaurus of Project Lex . . . a high degree of term compatibility with the Project Lex vocabulary has been a major objective in the development of the NASA Thesaurus."[32] The Manual for Building a Technical Thesaurus is an earlier version of Thesaurus Rules and Conventions, hereafter referred to as R&C. It agrees in all respect with the earlier version.[33] When a fuller explanation of the rules for forming terms than that afforded by the Introduction to the NASA Thesaurus has been needed, the R&C has been cited. Several dictionaries and encyclopedias were referred to for verification of the spelling of words or of proper names used in the terms. The three used most frequently were Webster's Third New International Dictionary, 1966, hereafter referred to as Webster's Third, Van Nostrand's Scientific Encyclopedia, 1958, and the NASA Dictionary of Technical Terms for Aerospace Use, 1965.

Except for those terms in the Thesaurus and SAL that matched exactly, forty-four per cent of the terms fell into this category, no term in the Thesaurus may be said to be the exact equivalent of a term in the SAL. Many of the exactly matching terms were not completely equivalent.

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[32] NASA Thesaurus, I, v.

[33] The Making of Test Thesaurus, p. 21. (The "Thesaurus Rules and Conventions" appear as Appendix 7 in this document and will hereinafter be known as R&C.)

Frequently the Thesaurus term subsumed two or more SAL terms which appeared as access entries. Because the terms themselves are of importance only in that they are mnemonic devices, it is not necessary that they match exactly in the Thesaurus and SAL in order to assume that they represent the same referent. This is consistent with the statement in the Introduction to the Thesaurus, "The terminology . . . is based in large part on the actual indexing vocabulary developed by NASA . . . ."[34] For that reason an attempt was made to find equivalent terms in the two sets whenever possible.

Two alternatives in equating terms are possible when there is not a one-to-one relationship between the terms in the two sets. The first alternative is to equate all variant forms in one set to the single form appearing in the other set. For example, both

VOLT and VOLTAGE

appear in the SAL, but only

VOLTAGE

appears in the Thesaurus. The decision was made, in going from the set of SAL terms to the set in the Thesaurus, to attempt to equate terms on a one-to-one basis. In this case, since the form

VOLTAGE

was found in both authority lists, and

VOLT

only in the SAL, the matching terms were considered equivalent and the variant form as unmatched. This situation occurs far more frequently in going from the Thesaurus set of terms to the terms in the SAL. For example, the Thesaurus terms,

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[34] NASA Thesaurus, I, v.

BEARING [an array term]
BEARING (DIRECTION)
BEARINGS

are all represented in the SAL by the single form,

BEARING

which apparently represents both Thesaurus forms

BEARING (DIRECTION) and BEARINGS.

The function of the array term in this case is to direct the user to variant forms representing different referents. The array term itself has no referent. It would be justifiable, therefore, in going from the Thesaurus forms to the SAL term to equate both forms to the single SAL term. This, in fact, would represent the actual relationship between the two sets of terms.

However, if the intent of the compilers of the Thesaurus is considered, this method of equating terms must be avoided because one of the major objectives in designing the Thesaurus was the elimination of ambiguity of this kind, i.e., the use of one word as a term to represent several referents.

The elimination or reduction of ambiguity of this kind is accomplished in the Thesaurus in several ways. A scope note may be used to define or delimit the applicability of a term. The structure of the Thesaurus permits the term to be defined by its subterms. In the construction of terms, ambiguity is avoided by either glossing the term or suffixing it in some predefined way. In equating terms in the Thesaurus with terms in the SAL, the intent of the compilers of the Thesaurus, i.e., to make it possible to discriminate among the several potential applications of a term, was considered of greater importance than the reality of the relationship between the two sets of terms. Therefore, an attempt was made to equate terms on

a one-to-one basis. When there were several forms of a term in the Thesaurus differentiated by glosses or suffixes, only the array term was equated to the SAL form and the other terms were considered unmatched. However, when only one form of a term appeared in the Thesaurus and one form in the SAL, the two terms were considered equivalent even though they might not match exactly.

Most of the terms in the sample from the Thesaurus either exactly matched an SAL term or were the plural form of the SAL singular. The largest category of terms was that including the terms that were exact matches in the two authority lists. Approximately 44 per cent of the terms in the sample were in this category. Not all of the SAL terms that exactly matched the Thesaurus form were in the singular. In some cases the SAL uses the plural form, for example, in the terms

ALGAE
BACTERIA
DATA
MEASURES
NUTS AND BOLTS

The use of the plural in these cases may be attributed to common usage because the terms are less frequently found in the singular form. The use of

MEASURES

may be an attempt to avoid ambiguity because the term "Measure" might represent the infinitive form "[To] Measure."

The statement is made in the Introduction to the Thesaurus that "The plural form has in general been used for subject terms. The singular form, however, is occasionally employed for specific processes, properties,

conditions, and hardware."[35] Although there is not a comparable statement in the introduction to the SAL, it is apparent, when the two sets of terms are compared, that most of the terms that are plural in the Thesaurus, are singular in the SAL. The second largest category of terms, approximately 35 per cent, are those in that category.

As a rule, access entries were not made in the Thesaurus for terms that appear in the plural in the Thesaurus and in the singular in the SAL. However, in the list of access entries from the Thesaurus that exactly match the SAL form of the term, several anomalies appear. In two cases, specific reference is made from the singular form to the plural form, i.e.,

RADIUS use RADII
FISH use FISHES.

There is no apparent reason for the explicit references from the singular form in either of these cases although both

RADIUS and FISH

are terms in the SAL. In one other case, the access entry is in the singular, i.e.,

MICROBE

although the plural would be the expected form in the Thesaurus.

Approximately 79 per cent of the terms in the sample of Thesaurus terms either exactly matched an SAL term or were the plural form of the SAL singular. Approximately 10 per cent of the terms in the sample differed in some way other than simply by number from the SAL equivalent term. The remaining terms, approximately 11 per cent, were not equated

[35] NASA Thesaurus, I, v.

to a term in the SAL. Altogether, almost two-thirds of the 15,000 terms in the Thesaurus were searched for and compared with terms in the SAL. The terms do not represent a random sample of the terms in the Thesaurus, but do represent a population of terms specifically related to the subject areas searched at the Pittsburgh RDC. Although there is no reason to believe that the terms in this population differ in any way from the remainder of the terms in the Thesaurus, there is no evidence to indicate that the results of comparing those terms with the terms in the SAL would be similar.

CHAPTER VII

THE DIFFERENCES BETWEEN THE TWO SETS OF TERMS

There were 1,015 terms in the Thesaurus and SAL differed from one another in some way other than solely by number. They constitute approximately 10 per cent of the sample. These terms were sorted into four categories based on those terms for which the difference between the Thesaurus and SAL forms of the term involves orthography, the use of Arabic numbers and Roman numerals, the use of the genitive, or the formation of compound words. These differences are slight and there can be no question that the terms from the two sets are equivalent. Any difference in form, however slight, is crucial in a mechanized information system using a search program in which the terms in the strategies and the document indexes either match or do not match.

The second category includes those terms for which the difference between the forms involves, (1) a modification of the suffix in either the specifier, i.e., the modifying word, or a modification of the suffix in the head of the construction, i.e., the word modified, or, (2) the use of a different word for the head of the construction. When a different word has been used for the head of the construction, usually an analagous relationship between a legal term and an access entry has been used as a model for the change.

The third category, "Recurring Patterns," includes a miscellaneous collection of subcategories. The use of "Recurring Patterns" is misleading because all of the term changes fit into patterns that recur. The only

justification for equating the terms in the two sets was that the terms were the most closely related in the two authority lists. In some cases, the change to the Thesaurus form must have depended upon some unknown rule because the SAL form apparently conforms to a form of the word acceptable in the Thesaurus as an index term.

The fourth category includes those terms for which the difference between the forms from the two sets is in the use of the gloss.

The difference between the access entry and the SAL form may be categorized in the same way as the differences between the legal Thesaurus term and the SAL form. Therefore, the access entries have been included in the following term comparisons. They have been marked with an asterisk (*) so that they may be distinguished from the legal entries.

A list of the terms in these categories for which examples appear on the following pages appears in Appendix B, pages 135 to 185.

A. Differences Due to Rules and Conventions

The differences in this section are dependent upon conventions that have been established for the development of terms in the indexing system and do not affect the referent of the term. How clearly the conventions have been established is reflected by the degree to which the terms conform to the pattern set for their development.

There are five subcategories of terms included in this section:

1. orthography.
2. the use of Roman numerals and arabic numbers.
3. the form of the genitive.
4. variant forms of compound words due to spacing or word division and hyphenation.
5. the effect of the change to a noun form.

Orthography

The word

GAGE

or its plural form is used consistently throughout the Thesaurus. The SAL is almost as consistent in its use of

GAUGE

which is used throughout except in one instance,

PHILLIP IONIZATION GAGE.

The term

SIPHON

is used throughout the Thesaurus and

SYPHON

throughout the SAL. There is no access entry for either SAL form in the

Thesaurus. However, the term

PRESSURE GAUGES.

the plural of the SAL form, is an access entry in the Thesaurus with a "Use" reference to the legal Thesaurus form,

PRESSURE GAGES.

For two similar terms in the Thesaurus,

ION GAGES and STRAIN GAGES

there is no reference to the SAL forms,

ION GAUGE and STRAIN GAUGE.

In two cases, the word "autogiro" in the Thesaurus changes to "autogyro" in the SAL. In the other instance in the sample, the form used is "autogyro" in both the Thesaurus and SAL, so that in these instances, "autogiro" may be the specific name and represent a correction of the SAL term. The two terms are:

Thesaurus	SAL
AVIAN 2/180 AUTOGIRO	AVIAN 2/180 AUTOGYRO
WA-116 AUTOGIRO	WA-116 AUTOGYRO

In these examples, it is apparent that there is some confusion as to how closely the index term must parallel a name. It may be more important to conform to an orthographic convention than to conform to the spelling used for specific referents.

The Thesaurus term

*CEPHALAGIA

is apparently a mispelling of the SAL term

CEPHALALGIA.

The Use of Roman Numerals and Arabic Numbers

The Thesaurus terms in the sample uniformly use an arabic number

throughout when a number forms part of a term. The SAL does not. In twenty-two cases in the sample, the arabic number in the Thesaurus term appeared as a roman numeral in the SAL term, e.g.,

Thesaurus	SAL
MIRAGE 3 AIRCRAFT	MIRAGE III AIRCRAFT
TITAN 1 ICBM	TITAN I ICBM

Use of the roman numeral in the SAL is too unpredictable to make possible a translation from the Thesaurus form without referring to the SAL for verification.

The Use of the Genitive

There are other differences between the Thesaurus and SAL forms that are less easily resolved. In the following lists, the terms from the Thesaurus are on the left and those from the SAL on the right.

Thesaurus	SAL
HOOKES LAW	HOOKE LAW
HUYGENS PRINCIPLE	HUYGEN PRINCIPLE
MILLS RATIO	MILL RATIO
PHILIPS IONIZATION GAGES	PHILLIP IONIZATION GAGE
SNELLS LAW	SNELL LAW
AIRY FUNCTION	AIRYS STRESS FUNCTION
*POCKELS EFFECT	POCKEL EFFECT
*YOUNG MODULUS	YOUNGS MODULUS

The Thesaurus form may represent a correction of the earlier SAL form and denote either a corrected version of the name, i.e., "Hookes" rather than "Hooke," or the "s" sign may indicate the plural, i.e., the law may be attributed to more than one "Hooke." Another explanation is that this is an attempt to represent the genitive and the recommendation in the R&C, "commas, periods, apostrophes and most hyphens should be excluded since they are difficult to handle consistently, complicate machine processing of the thesaurus, and are not necessary to convey the meaning

of the terms."[36] In three of the above terms, "Huygens,"[37] "Philips,"[38] and "Mills,"[39] the "s" represents a correction in the spelling of the name as does the deletion of the terminal "s" in "Youngs."[40] Since the other names are correctly spelled, the "s" must represent the genitive as it does in

ADDISONS DISEASE

a term that appears in the same form in both authority lists. Evidently no form has been established for this kind of term in the Thesaurus.

If necessary punctuation of this nature is difficult to handle in machine searchable systems, the use of the genitive at all should be questioned. The only advantage in its use is its ability to specify the referent. Used as it is above, its effect is quite the opposite as it may confuse rather than clarify.

Compound Words

Another category of differences between the terms in the Thesaurus and the SAL is in the handling of compound words. In the following, the first list represents the term as found in the Thesaurus; the second list consists of similar terms that are the same in both the Thesaurus and

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[36] R&C. p. 143.

[37] National Aeronautics and Space Administration, Scientific and Technical Information Division, Dictionary of Technical Terms for Aerospace Use, (Washington, D. C.:Government Printing Office, 1965), p. 136.

[38] Ibid, p. 202.

[39] Maurice G. Kendall and W. R. Buckland, A Dictionary of Statistical Terms, 2nd Ed., (N. Y.:Hafner Publ. Co., 1967), p. 182.

[40] McGraw-Hill Encyclopedia of Science and Technology, (N. Y.:McGraw-Hill Book Company, 1966), XV, 229.

SAL.

Thesaurus	SAL	Both
AIR FLOW	AIRFLOW	AIRGLOW
AIR MAIL	AIRMAIL	AIRSPACE
AIRSPEED	AIR SPEED	BACKWASH
AUDIO FREQUENCIES	AUDIOFREQUENCY	AUDIO EQUIPMENT
BANDPASS FILTERS	BAND PASS FILTER	CORE FLOW
CROSSLINKING	CROSS LINKING	DOWNRANGE
FLASH POINT	FLASHPOINT	FLASHBACK
FLOWMETERS	FLOW METER	RANGEFINDING
OPTICAL RANGE FINDERS	OPTICAL RANGEFINDER	
PIPE FLOW	PIPEFLOW	
PULSEJET ENGINES	PULSE JET ENGINE	
RANGE FINDERS	RANGEFINDER	
ROCK BOLTS	ROCKBOLT	
WASPALOY	WASP ALLOY	

The Thesaurus form of the final term on the first two lists may represent a correction since this is a trade name although not so indicated by the usual parenthesized gloss. These terms pose a particularly difficult problem in attempting to relate the two sets of terms because of their different location in an alphabetic arrangement.

It is not clear from the form of term used in the Thesaurus that any rule has been established concerning compounds that would make possible the addition of new terms to the vocabulary.

Hyphenation:- The problem of hyphenation is another aspect of the problem of handling compound words. Ninety-three of the legal Thesaurus terms and thirty-six of the access entries differ from the corresponding SAL forms in hypenation. In ninety of the legal terms and in thirty-one of the access entries, the hyphen was not included in the Thesaurus term although it appeared in the SAL form. In eight cases, the Thesaurus term includes the hyphen although the SAL term does not. Six of the Thesaurus terms were names of specific aircraft and will be discussed later. The other two terms in which a hyphen is included in the Thesaurus form are

*COMMAND-CONTROL and MAGNETO-OPTICS.

Both lists include a hyphen in the term

ELECTRO-OPTICS

The hyphen is not always used to connect the prefix to the stem when two vowels occur in sequence. Both lists include the unhyphenated form

MICROORGANISM (S).

The following list includes examples of terms in which a hyphen is used in the SAL form but not in the Thesaurus form of the term.

Thesaurus	SAL
ALL SKY PHOTOGRAPHY	ALL-SKY PHOTOGRAPHY
C BAND	C-BAND
FAN IN WING AIRCRAFT	FAN-IN-WING AIRCRAFT
H ALPHA LINE	H-ALPHA LINE
SELF ALIGNMENT	SELF-ALIGNMENT
SNAP L	SNAP-L
TWO DIMENSIONAL BODIES	TWO-DIMENSIONAL BODY
WING FUSELAGE STORES	WING-FUSELAGE-STORE
X RAY _____	X-RAY _____

The following are examples of terms in which both the Thesaurus and the SAL include a hyphen.

ALL-WEATHER AIR NAVIGATION
CDC 160-A COMPUTER
CH- 21 HELICOPTER
CUT-OFF
E- 1 LAYER
ELECTRO-OPTICS
FUEL-AIR RATIO
GASEOUS SELF-DIFFUSION
KEL-F
MAXWELL-MOHR METHOD
OGO-A
SIDE-LOOKING RADAR
SINGLE-PHASE FLOW
POST-BLAST NUCLEAR RADIATION
SOLAR X-RAYS/ [SOLAR X-RAY]

From the preceding list, it seems clear that the hyphen is to be retained in the following term pattern,

_____-_____ _____

when the first two blanks represent the names of individuals and the third

blank represents the head of the construction. In the sample, in both the SAL and Thesaurus, this pattern is followed consistently as may be seen from the following examples of terms that are the same in the SAL and Thesaurus.

CROCCO-LEE THEORY
FOKKER-PLANCK EQUATION
JOULE-THOMSON EFFECT

This pattern occurred sixteen times in the sample. A slight modification of this pattern, i.e.,

_____-_____-_____ _____,

occurs once, in the term,

BARDEEN-COOPER-SCHRIEFFER THEORY.

Another slight modification occurs with the substitution of

ARMY-NAVY _____

for the names of individuals.

Other than in the preceeding configuration in which the hyphen has been included and in the term "x ray" and similar terms, e.g., "self diffusion," in which the hyphen has been eliminated when they are the initial words in the term, there is no easily seen pattern for the use or non-use of the hyphen in either the Thesaurus or the SAL. The recommendation in the R&C, "Hyphens should be used only in terms whose intended meaning would be altered by the omission of the hyphen,"[41] is apparently of little significance. The only time a hyphen changes the term's referent is in a situation similar to the following in which, out of context, the meaning would not be clear if the hyphen were omitted,

---

[41] "R&C," p. 143.

RESORT as a last _____.

RE-SORT to sort again.

The hyphen, when it is used, for example, to connect two proper names, is not being used to specify the referent but simply because this is the conventional way of writing such phrases, and it may even make them somewhat easier to read. Terms that include proper names, with or without hyphens, are the least likely to be applied to an incorrect referent. There is nothing incorrect in using a hyphen in this configuration but it should be recognized as a conventional use rather than as one designed for clarification.

There are, apparently, no standard rules for either word division or hyphenation except those that have been developed for use in individual dictionaries and other authority lists. These may not meet the requirements for index terms to be used in machine searchable systems.

The Effect of the Change to a Noun Form

Noun to Another Form:- The following statement is in the preface to the Thesaurus, "Subject terms are presented in the noun form. Expressions that were presented in earlier vocabularies as adjectives or verbs have been converted to the noun form."[42] In reversing this process, i.e., finding SAL equivalents for Thesaurus terms, it was impossible to equate the Thesaurus noun with the SAL adjective or substantive form except in those cases in which the adjective form was the only form in which the term appeared in the SAL. For example, the Thesaurus

CHEMICALS

[42]NASA Thesaurus, I, v.

does not necessarily have the same referents as the SAL

CHEMICAL

because

CHEMICAL

also appears in the SAL as part of multiple-word terms,

CHEMICAL _____.

Prior to the publication of the Thesaurus the multiple-word terms were frequently exploded into their component parts. For that reason, although

CHEMICALS

and

CHEMICAL

may at times have the same referent, at other times the term

CHEMICAL

may be the fragment of a multiple-word term. There are a number of similar terms for which no SAL term was substituted.

There were thirty legal entries and twelve access entries that appeared as nouns in the Thesaurus for which the most closely related term in the SAL was an adjective, a verb, or another form of the noun. It is frequently impossible to determine what the form represents when it is out of context. A list of terms in this category appears in Appendix B, page 144.

The Effect of the Change to a Noun Form

The Use of the "-ing" suffix:- The "-ing" suffix is "Used to form nouns, primarily abstract nouns of action from verbs, and also, by analogy, from nouns, adverbs and other words . . .. Its meanings are: an act or fact of doing (what the verbal root denotes) often conveying the idea of process, continuance, art or other modification . . .. The idea of

among them"[44] In the SAL apparently no attempt was made to discriminate in this way.

For thirty-six Thesaurus terms suffixed by "-ing," the most closely related SAL term was suffixed by "-ion." For four terms in this category, there were "Used For" references for the form of the term appearing in the SAL.

Thesaurus		SAL
ATOMIZING	used for	* ATOMIZATION
DISSOLVING		* DISSOLUTION
HOMOGENIZING		* HOMOGENIZATION
COMPRESSING		* RECOMPRESSION
		* THERMOCOMPRESSION

The final term above does not have a reference to

COMPRESSION,

which does not appear in the Thesaurus but does appear in the SAL.

For thirty-two other Thesaurus terms in the sample suffixed by "-ing", the most closely related SAL term ends in "-ation" or "-ion", although there is no access entry for the SAL form. In four cases both forms of the term are in the Thesaurus.

Thesaurus	SAL
DISTRIBUTING	DISTRIBUTION
DISTRIBUTION [Array Term]	
DISTRIBUTION (PROPERTY)	
DISPERSING	DISPERSION
DISPERSION [Array Term]	
DISPERSIONS	
ILLUMINATING	ILLUMINATION
ILLUMINATION [Array Term]	
RETAINING	RETENTION
RETENTION [Array Term]	
RETENTION (PSYCHOLOGY)	

In each of the above cases, the SAL form was substituted for the

---

[44] R&C, p. 142

continuance often distinguishes the sense of verbal nouns from that of nouns identical in form with the verb, the latter denoting a single, completed act."[43]

For seventy-one Thesaurus terms ending in "-ing" the most closely related SAL term was the stem of the word. For example, for the Thesaurus terms

CHARRING
DEEP DRAWING

the equivalent SAL terms were

CHAR
DEEP DRAW.

The SAL terms in this category were substituted for the Thesaurus term only when the term appeared in one form in the Thesaurus. Otherwise, as shown below, the SAL term would have represented several Thesaurus terms.

Thesaurus	SAL
BALANCING	BALANCE
BALANCE	
BUDGETING	BUDGET
BUDGET	
CHIPPING	CHIP
CHIPS	

A list of the equivalent SAL and Thesaurus terms in this category appears in Appendix B, pages 146-148.

The The R&C suggests that "The meaning of terms can be clarified or made more specific in the following ways: ". . . c. Employ the "-ing" suffix for processes and the "-ion" suffix or other appropriate suffixes for materials, characteristics, etc., when necessary to distinguish clearly

---

[43]Webster's Third, p. 1277.

Array Term only. A list of the terms in this category, i.e., the terms in which the SAL form was suffixed by "-ion" and the Thesaurus form by "-ing," appears in Appendix B, pages 149-150.

In one instance, this process is apparently reversed in the following term,

Thesaurus	SAL
ERROR DETECTION CODE	ERROR DETECTING CODE

Both the SAL and Thesaurus use the same form,

ERROR CORRECTING DEVICE (S)

for a similar term.

B. Term Modifications Based on the "Used For" Structure

The following examples of differences between the sets of terms, those in the Thesaurus and those in the SAL, are apparently the result of the establishment of certain conventions in the selection of words to be used as terms or as part of terms. The conventions are not stated but are implicit in the "Use" and "Used For" structure.

In the following lists, the form of the term found in the Thesaurus appears in the column on the left side of the page and form found in the SAL, on the right. The terms following the "Used For" reference are access entries in the Thesaurus but appear in the SAL as legal terms.

This part of the study is not concerned with the results of the explicit "Use" or "Used For" reference but with how this structure affects other terms, particularly those multiple word terms in both authority lists that include the access or referred-to legal entries as part of the term. There are four kinds of term modification based on the "Used For" configuration.

1. The term modifications that result when the "Used For" structure directly affects the head of the construction.
2. The term modifications that are a result of an apparent reversal of the above configuration.
3. The term modifications that are a result when the "Used For" structure affects the specifier in the term.
4. The term modifications based on an analogy with a similar term.

Affecting the Head of the Construction

When there was apparently no SAL equivalent for a multiple word term

appearing in the Thesaurus, it was frequently useful to examine the "Used For" entries in the Thesaurus listed under the head of the construction. For example,

LABORATORY EQUIPMENT

appears in the Thesaurus but not in the SAL. However, listed under

EQUIPMENT

in the Thesaurus as a "Used For" entry is the term

APPARATUS.

Because the term

LABORATORY APPARATUS

does appear in the SAL, it was substituted for the Thesaurus term,

LABORATORY EQUIPMENT.

In four other Thesaurus terms using

EQUIPMENT

as the head of the construction, the SAL terms substituted, all replaced "Equipment" with

APPARATUS.

For one term in the Thesaurus,

VACUUM APPARATUS,

it was necessary to reverse this procedure because the equivalent term in the SAL was

VACUUM EQUIPMENT.

The following table lists the terms used as models, the Thesaurus term and the SAL equivalent.

Thesaurus		SAL
EQUIPMENT	used for	*APPARATUS
DISTILLATION EQUIPMENT		DISTILLATION APPARATUS
LABORATORY EQUIPMENT		LABORATORY APPARATUS

MICROWAVE EQUIPMENT PHOTOGRAPHIC EQUIPMENT		MICROWAVE APPARATUS PHOTOGRAPHIC APPARATUS
CONTROL FEEDBACK CONTROL ADAPTIVE CONTROL	used for	*CONTROL SYSTEM(S) FEEDBACK CONTROL SYSTEM *ADAPTIVE CONTROL SYSTEM
STRUCTURES PLASTIC AIRCRAFT STRUCTURES STRESSED-SKIN STRUCTURES AIRCRAFT STRUCTURES MISSILE STRUCTURES	used for	*CONSTRUCTION PLASTIC AIRCRAFT CONSTRUCTION STRESSED-SKIN CONSTRUCTION *AIRCRAFT CONSTRUCTION *MISSILE CONSTRUCTION
COSMIC RAYS PRIMARY COSMIC RAYS	used for	*COSMIC RADIATION PRIMARY COSMIC RADIATION
DIFFUSION SURFACE DIFFUSION	used for	*DIFFUSION EFFECT SURFACE DIFFUSION EFFECT
FLIGHT *HIGH ALTITUDE FLIGHT *HIGH SPEED FLIGHT	used for	*FLYING HIGH ALTITUDE FLYING HIGH SPEED FLYING
MISSILES SHILLELAGH MISSILE SEACAT MISSLE	used for	*GUIDED MISSILE(S) SHILLELAGH GUIDED MISSLE SEACAT GUIDED MISSLE
INSTRUMENTS AIRCRAFT INSTRUMENTS SPACECRAFT INSTRUMENTS SATELLITE INSTRUMENTS	used for	*INSTRUMENTATION AIRCRAFT INSTRUMENTATION SPACECRAFT INSTRUMENTATION SATELLITE INSTRUMENTATION
LAUNCHERS GUN LAUNCHER ROCKET LAUNCHER	used for	*LAUNCHING DEVICES GUN LAUNCHING DEVICE ROCKET LAUNCHING DEVICE
LININGS ROCKET LININGS	used for	*LINER(S) ROCKET LINER
MEASURING INSTRUMENTS SHOCK MEASURING INSTRUMENTS	used for	*MEASURING APPARATUS SHOCK MEASURING APPARATUS
FLUX DENSITY *ATMOSPHERIC NEUTRON FLUX DENSITY	used for	*FLUX (RATE PER UNIT AREA)[45] ATMOSPHERIC NEUTRON FLUX
TRANSFER ORBITS *IMPULSE TRANSFER *HOHMANN TRANSFER ORBITS	used for	*ORBITAL TRANSFER INPULSE ORBITAL TRANSFER HOHMANN ORBITAL TRANSFER

[45] FLUX appears in the SAL in an unglossed form.

HEAT OF VAPORIZATION ENERGY OF FORMATION HEAT OF SOLUTION	used for	*VAPORIZATION HEAT FORMATION ENERGY SOLUTION HEAT
TESTERS *COMPRESSION TESTERS	used for	*TESTING MACHINES[46] COMPRESSION TESTING MACHINE
TESTS STATIC TESTS	used for	TESTING STATIC TESTING

Altogether sixteen terms in the sample of Thesaurus terms used

TESTS

as the head of the construction. The equivalent SAL term used

TESTING.

A Reversal of the Common Pattern

Although the preceding set of terms follows a pattern established in the Thesaurus if the "Used For" entries may be expanded to cover all occurences of the word in multiple word terms, in some cases an apparent reversal of the common pattern takes place. One instance has been previously noted in the terms,

VACUUM APPARATUS

in the Thesaurus for which the equivalent term in the SAL is

VACUUM EQUIPMENT.

Another Thesaurus term

PRIMARY COSMIC RAYS

was not in the SAL. However, there was a "Used For" reference to

*COSMIC RADIATION

from the term

COSMIC RAYS.

---

[46]TESTING MACHINES does not appear as a separate term in the SAL.

These terms were used as a model and the SAL term,

PRIMARY COSMIC RADIATION

used as the equivalent term for the Thesaurus term,

PRIMARY COSMIC RAYS.

When a similar Thesaurus term,

INCIDENT RADIATION

is considered, an apparent reversal takes place if the equivalent SAL term is

INCIDENT RAY.

The following terms apparently all reverse the pattern established by the access entries.

Thesaurus		SAL
COSMIC RAYS PRIMARY COSMIC RAYS INCIDENT RADIATION	used for	*COSMIC RADIATION PRIMARY COSMIC RADIATION INCIDENT RAY
ALLOYS REFRACTORY METAL ALLOY	used for	*METAL ALLOY(S) REFRACTORY ALLOY
LUMINAIRES MERCURY LAMPS XENON LAMPS	used for	*LIGHT(S), *LAMP(S) MERCURY LIGHT XENON LIGHT
EQUIPMENT VACUUM APPARATUS	used for	*APPARATUS VACUUM EQUIPMENT
MOTION BROWNIAN MOVEMENTS	used for	*MOVEMENT(S) BROWNIAN MOTION

For a similar set of terms, there are "Used For" references relating the Thesaurus form to the SAL form. For the third term there is no "Used For" reference and it is an apparent reversal of the pattern established by the first two terms:

Thesaurus		SAL
COMPUTERIZED SIMULATION	used for	*COMPUTER SIMULATION
PRESSURIZED CABINS PRESSURE SUIT	used for	*PRESSURE CABIN(S) PRESSURIZED SUIT

Both PRESSURIZED CABIN and PRESSURE CABIN appear in the SAL.

Affecting the Specifier in the Term

For two terms, the specifier rather than the primary term is the word changed by the "Used For" entry:

METEOROIDS	used for	*METEOR(S)
METEOROID SHOWERS		METEOR SHOWER
METEOROID DUST CLOUD	used for	METEOR DUST CLOUD

Terms Modified by an Analogy with A Similar Term

For the following terms, there is not a direct "Used For" entry in the Thesaurus that would justify the substitution of the SAL term but it has been possible to use as a model a similar term and its "Used For" entry. For example, the Thesaurus term

HYDROGEN OXYGEN FUEL CELLS

does not appear in the SAL and does not have a "Used For" entry in the Thesaurus that might apply to the appropriate SAL term. However, for the Thesaurus term,

HYDROGEN OXYGEN ENGINES,

there is a "Used For" term that does appear in the SAL,

*HYDROX ENGINE(S)

All of the following term substitutions were based on similar models.

Thesaurus		SAL
AIRCRAFT	used for	MILITARY AIRCRAFT
GYRODYNE AIRCRAFT		GYRODYNE MILITARY AIRCRAFT
*BEECH AIRCRAFT		BEECH MILITARY AIRCRAFT
F REGION	used for	*F LAYER
F 1 REGION		F- 1 LAYER
F 2 REGION		F- 2 LAYER
ALPHA PARTICLES	used for	*ALPHA RADIATION

GAMMA PARTICLES	used for	*GAMMA RADIATION
BETA PARTICLES		BETA RADIATION
SPACECRAFT RADIATORS	used for	*SPACE RADIATORS
SPACECRAFT CABINS		SPACE CABINS
SPACECRAFT CABIN SIMULATORS		SPACE CABIN SIMULATOR
RC CIRCUITS	used for	*RC NETWORK
RL CIRCUITS		RL NETWORK
COUPLING CIRCUITS		COUPLING NETWORK
TORQUEMETERS	used for	*TORQUE MEASURING APPARATUS
VIBRATION METERS		VIBRATION MEASURING APPARATUS
THERMAL STABILITY	used for	*THERMOSTABILITY
THERMAL CONDUCTIVITY		THERMOCONDUCTIVITY
THERMAL CONDUCTIVITY GAGES		THERMOCONDUCTIVITY GUAGE
PLASTIC PROPERTIES	used for	*PLASTICITY
TENSILE PROPERTIES		TENSILITY

Process or Instrument

Frequently, the SAL and Thesaurus include only one form of a term, suffixed in one authority list to imply a process, and in the other, an instrument. This configuration is represented in the "Used For" structure by the following example.

Thesaurus		SAL
SPECTROMETERS	used for	*SPECTROGRAPH(S)
		*SPECTROMETRY

All three terms appear in the SAL. This set of terms was used as a model for the following sets of equivalent terms.

Thesaurus	SAL
NEUTRON SPECTROMETERS	NEUTRON SPECTROMETRY
SOLAR SPECTROMETERS	SOLAR SPECTROGRAPH
PSYCHROMETERS	PSYCHROMETRY
ULTRAVIOLET SPECTROPHOTOMETERS	ULTRAVIOLET SPECTROPHOTOMETRY
MICROWAVE REFLECTOMETERS	MICROWAVE REFLECTROMETRY

An apparent reversal of this pattern takes place with the term

OPTOMETRY

which appears in the Thesaurus, and

OPTOMETER

which appears in the SAL.

Nineteen similar configurations were found in the sample. The SAL form was substituted when either the instrument or process appeared in the Thesaurus, but not both, and when only one form, instrument or process, appeared in the SAL.

C. Term Modifications Based on Recurring Patterns

For the preceding pairs of terms, there has either been a direct "Used For" reference, as in

TESTS Used For TESTING

or an analogy with a similar term that would justify substituting the SAL form for the Thesaurus form. There are no comparable models for the following terms. The differences between the two sets of terms in this group fall into the following subcategories:

1. a difference in the form of the word used as the specifier.
2. a change in the word used as the head of the construction.
3. the use of the word "system" as head of the construction.
4. the change from one noun form to another noun form.
5. the differing forms used to identify rockets, engines, and missiles.

Analogous to the preceding forms but using as the head of the construction words for which there are no "Used For" entries are the following"

*MOLECULAR BONDS	MOLECULAR BONDING
BLAST LOADS	BLAST LOADING
COMPRESSION LOADS	COMPRESSION LOADING
SPOT WELDS	SPOT WELDING

Adjective/Adjective Modifications

Although the Thesaurus uses both form, ELECTRIC and ELECTRICAL as specifiers, only ELECTRIC is found in the SAL. The following Thesaurus terms used the form ELECTRICAL which appeared as ELECTRIC in the SAL:

Thesaurus	SAL
ELECTRICAL GROUNDING	ELECTRIC GROUNDING
ELECTRICAL IMPEDANCE	ELECTRIC IMPEDANCE
ELECTRICAL INSULATION	ELECTRIC INSULATION

ELECTRICAL MEASUREMENT	ELECTRIC MEASUREMENT
ELECTRICAL PROPERTIES	ELECTRIC PROPERTY
ELECTRICAL RESISTANCE	ELECTRIC RESISTANCE
*ELECTRICAL BREAKDOWN	ELECTRIC BREAKDOWN
*ELECTRICAL CONDUCTIVITY	ELECTRIC CONDUCTIVITY
*ELECTRICAL ENERGY	ELECTRIC ENERGY

For two terms,

ELECTRIC LEADS and ELECTRICAL LEADS,

the head of the construction is the same in both terms. Both are access entries in the Thesaurus, i.e.,

*ELECTRIC LEADS Use ELECTRIC WIRE
*ELECTRICAL LEADS Use ELECTRIC CONDUCTORS

Some rule dependent on subject knowledge must have been established for the use of these two terms as specifiers because there is no obvious difference between the terms using "Electric" and those using "Electrical."

Noun/Adjective Modifications

An analogous situation occurs with the specifiers ION and IONIC. Both forms occur in both the SAL and Thesaurus and in the sample, ION is the form used most frequently. In two cases the SAL and Thesaurus use different forms.

Thesaurus	SAL
ION PROPULSION	IONIC PROPULSION
IONIC MOBILITY	ION MOBILITY

The two preceding term formations may serve as models for a class of similar terms. The specifier in

ELECTRIC _____

is in the adjective form and the addition of the "al" suffix does not change the form of the specifier. In the case of

ION _____,

there is a change to the adjective form with the addition of the "ic"

suffix.

Similar to the preceding configurations are the following terms, all of which appear in one authority list as a nominal compound and in the other list as an adjective-noun compound. Because of the ambiguity often inherent in nominal compounds, these terms may not have the same referents.

Thesaurus	SAL
ATMOSPHERIC MODELS	ATMOSPHERE MODEL
EXPERIMENTAL DESIGN	EXPERIMENT DESIGN
LOGIC DESIGN	LOGICAL DESIGN
PARABOLOID MIRRORS	PARABOLOIDAL MIRROR
PHENOLIC RESINS	PHENOL RESIN
*PLANET ORIGINS	PLANETARY ORIGIN
*MAXWELLIAN DISTRIBUTION (DENSITY)	MAXWELL DISTRIBUTION

The last term on this list is a form of the genitive. Another form, apparently meant to represent the genitive, in which the word is suffixed by an "-s" is discussed in an earlier section.

The following pairs of terms are similar to the preceding set. They differ in that the specifiers are not in a noun/adjective relationship.

*TOWED TARGETS	TOW TARGET
PULSE GENERATOR	PULSED GENERATOR
COMMUNICATION SATELLITES	COMMUNICATIONS SATELLITES
HUMAN FACTORS LABORATORIES	HUMAN FACTOR LABORATORY

A Changed Head of the Construction

In the preceding lists of term changes, the head of the construction has not been changed unless such a change was justified by an examination of the "Used For" structure. Ordinarily, the head of the construction is the essential part of the term, and to change it to another word changes the referent, even though the specifier remains the same. For example, the two terms, "grey wall" and "pink wall" both refer to "wall" and the

basic referent is unchanged. However, the two terms, "grey wall" and "grey house" have two different referents although the specifier remains the same. If the two terms, "grey wall" and "grey fence" are considered, it becomes apparent that at times, in some information systems, the two terms might have the same referent.

The following terms all use, as the head of the construction, terms that are apparently interchangeable within the system.

In the following pairs of terms, the head of the construction is different in the SAL and Thesaurus forms. However, the modifier is the same in every case and because it is a proper name, its specificity compensates for the difference in the head of the construction.

Thesaurus	SAL
BRAVAIS CRYSTALS	BRAVAIS LATTICE
CZOCHRAISKI METHOD	CZOCHRAISKI APPARATUS
DUFFING DIFFERENTIAL EQUATION	DUFFING EQUATION
FRANCK-CONDON PRINCIPLE	FRANCK-CONDON FACTOR
GIBBS ADSORPTION EQUATION	GIBBS EQUATION
VERMEUIL PROCESS	VERMEUIL TECHNIQUE
WEIBULL DENSITY	WEIBULL DISTRIBUTION
WIDMANSTATTEN STRUCTURE	WIDMANSTATTEN PATTERN

For a number of terms, the difference between the SAL form and the Thesaurus form is a change in the head of the construction with the specifier remaining the same in both the SAL and Thesaurus. There is no pattern in these changes although all involve words of such little semantic weight that they may well be interchangeable.

Thesaurus	SAL
BODY-WING AND TAIL CONFIGURATIONS	BODY-WING AND TAIL COMBINATION
CRITICAL PATH METHOD	CRITICAL PATH ANALYSIS
EXTRAVEHICULAR ACTIVITY	EXTRAVEHICULAR OPERATION
FINITE DIFFERENCE THEORY	FINITE DIFFERENCE METHOD
ELECTRONIC RECORDING SYSTEMS	ELECTRONIC RECORDING INSTRUMENT
REFRIGERATING MACHINERY	REFRIGERATING EQUIPMENT
TIMING DEVICES	TIMING APPARATUS
MICROMINATURIZED ELECTRONIC DEVICE	MICROMINATURIZED ELECTRONIC EQUIPMENT

POSITIONING DEVICES (MACHINERY)	POSITIONING EQUIPMENT
ENGINE MONITORING INSTRUMENTS	ENGINE MONITORING SYSTEM
TRACKING NETWORKS	TRACKING SYSTEM
INCENDIARY AMMUNITION	INCENDIARY WEAPON
LONG TERM EFFECTS	LONG PERIOD EFFECT
MONOMOLECULAR FILMS	MONOMOLECULAR LAYER
PERSONALITY TESTS	PERSONALITY ASSESSMENT
SIMILARITY THEOREM	SIMILARITY HYPOTHESIS

System and Lack of It

Seven terms in the SAL include the word "system" to which does not appear in the most closely related Thesaurus term. This word has been omitted from the Thesaurus form of term in other categories. Although the SAL form was substituted for the Thesaurus form, these pairs of terms may not have the same referents.

Thesaurus	SAL
DIGITAL NAVIGATION	DIGITAL NAVIGATION SYSTEM
FUEL TANK PRESSURIZATION	FUEL TANK PRESSURIZATION SYSTEM
GAS COOLING	GAS COOLING SYSTEM
INERTIAL COORDINATES	INERTIAL COORDINATE SYSTEM
MONOPOLE ANTENNAS	MONOPOLE ANTENNA SYSTEM
SYMBOLIC PROGRAMMING	SYMBOLIC PROGRAMMING SYSTEM /SPS/
TRAJECTORY MEASUREMENT	TRAJECTORY MEASURING SYSTEM
SCHUMANN-RUNGE BANDS	SCHUMANN-RUNGE BAND SYSTEM
VOICE DATA PROCESSING	VOICE DATA PROCESSING SYSTEM
*AUTOMATIC DATA PROCESSING	AUTOMATIC DATA PROCESSING SYSTEM
*DIGITAL COMMUNICATION	DIGITAL COMMUNICATIONS SYSTEM
*FREQUENCY TRANSLATION	FREQUENCY TRANSLATION SYSTEM
*RAPID AUTOMATIC MALFUNCTION ISOLATION	RAPID AUTOMATIC MALFUNCTION ISOLATION SYSTEM
*REFLECTOR SATELLITES	REFLECTOR SATELLITE SYSTEM

Uncategorized Changes

In the following list, the SAL term was substituted for the Thesaurus term. Although the SAL form includes a word not present in the Thesaurus form, the SAL form was the most closely related term found.

Thesaurus	SAL
CRYSTAL DEFECTS	CRYSTAL STRUCTURE DEFECT
DISTRIBUTED AMPLIFIERS	DISTRIBUTED EMISSION AMPLIFIER
EARTH-MARS TRAJECTORIES	EARTH-MARS RENDEZVOUS TRAJECTORY

INERTIALESS STEERABLE ANTENNAS	INERTIALESS STEERABLE COMMUNICATIONS ANTENNA
SIMULTANEOUS EQUATIONS	SIMULTANEOUS LINEAR EQUATION
SPARK MACHINING	SPARK EROSION MACHINING
ZODIACAL DUST	ZODIACAL DUST CLOUD

In the following list of terms, the most closely related forms have been related, although they do not apparently fall into a particular pattern. The terms in both sets are noun forms and many of the SAL terms do not differ in form from terms acceptable as index terms in the Thesaurus. Some of the changes may have been made in the interests of accuracy.

Thesaurus	SAL
ABLATIVE NOSE CONES	ABLATING NOSE CONE
ABLATIVE MATERIALS	ABLATING MATERIAL
AUSTENITIC STAINLESS STEELS	AUSTENITIC STEEL
MARTENSITIC STAINLESS STEELS	MARTENSITIC STEEL
AUTOCLAVING	AUTOCLAVE PROCESS
HYDROFORMING	HYDROFORM PROCESS
BITUMENS	BITUMINOUS MATERIAL
ANTIINFECTIVES AND ANTIBACTERIALS	ANTIBACTERIALS
CUPOLAS	CUPULA
EVAPORATIVE COOLING	EVAPORATION COOLING
GROUND BASED CONTROL	GROUND CONTROL
JODRELL BANK OBSERVATORY	JODRELL BANK
LIGHT SPEED	LIGHT, SPEED OF
LIQUEFIED GASES	LIQUID GAS
OPERATING TEMPERATURE	OPERATIVE TEMPERATURE
TOXINS AND ANTITOXINS	TOXIN
*RADIOACTIVE FALLOUT PARTICLES	RADIOACTIVE FALLOUT
*REACTION JET ATTITUDE CONTROL	REACTION JET ATTITUDE CONTROL TECHNIQUE
*VAN ALLEN RADIATION BELTS	VAN ALLEN BELT
*DELTA DAGGER AIRCRAFT	DELTA DAGGER
*DELTA DART AIRCRAFT	DELTA DART
HYPERGOLIC ROCKET PROPELLANTS	HYPERGOLIC PROPELLANT
CRYOGENIC ROCKET PROPELLANTS	CRYOGENIC PROPELLANT
RP-1 ROCKET PROPELLANTS	RP-1 ROCKET FUEL

Noun to Noun Form

There seems to be little reason for many of the following changes. Both are nominal forms. "Machine" also occurs in the SAL as part of

multiple word terms.

Thesaurus	SAL
ALLOTROPY	ALLOTROPISM
FERROELECTRICITY	FERROELECTRICS
MACHINERY	MACHINE
TURBOMACHINERY	TURBOMACHINE
MEDICAL SCIENCE	MEDICINE
MICROTOMY	MICROTOME
PHOTOCHROMISM	PHOTOCHROMY
RESILIENCE	RESILIENCY
TIME DEPENDENCE	TIME DEPENDENCY
*DISCOVERING	DISCOVERY
*ENLARGING	ENLARGEMENT
*VALIDATION	VALIDITY

Engines and Missiles

One hundred and seventeen terms in the sample which appeared in different forms in the Thesaurus and SAL referred to specific aircraft, spacecraft, or engines, or to types of aircraft or spacecraft. The differences between the terms were due to spacing, hyphenation, the addition or omission of a specifier or to a combination of these variables. An expert in aircraft nomenclature could determine whether a form has been established and adhered to. Some inconsistencies in the SAL terminology are apparent.

In sixty-three cases, the Thesaurus omitted a specifier included in the SAL form, such as "turbojet" or "rocket", when referring to a specific engine. Evidently the coding was adequate to descirbe the specific engine referred to and the SAL term was redundant.

Thesaurus	SAL
AJ- 10 ENGINE	AJ- 10 ROCKET ENGINE
CF-700 ENGINE	CF-700 TURBOFAN ENGINE

In one case the SAL form uses "motor" in place of "engine".

TU-22 ENGINE	TU-22 MOTOR

In four instances, the Thesaurus form includes a hyphen connecting the alphabetic part of the code with the numeric part.

SA- 330 HELICOPTER	SA 330 HELICOPTER
TSR-2 AIRCRAFT	TSR 2 AIRCRAFT
RA- 28 ENGINE	RA 28 JET ENGINE
TF-106 ENGINE	TF 106 AIRCRAFT ENGINE

In seven terms, the Thesaurus included the word "satellite" for referents identified only by the code in the SAL.

S- 16 SATELLITE	S-16
S- 17 SATELLITE	S-17

In every term in the sample, the word "missile" is used in the Thesaurus form of the term. The SAL form of the term may use "guided missile", "missile", "rocket" or in one case, "vehicle".

Thesaurus	SAL
SKYBOLT MISSILE	SKYBOLT VEHICLE
V-1 MISSILE	V-1 ROCKET
SPARROW MISSILES	SPARROW ROCKET

In six cases, the most closely related SAL term omits the word "engine." These pairs of terms may not have the same referents.

LOW VOLUME RAMJET ENGINES	LOW VOLUME ROCKET
LOW WING AIRCRAFT	LOW WING
NUCLEAR RAMJET ENGINES	NUCLEAR RAMJET

Spacing Between Words of the Term

Nineteen of the terms differ only in the spacing of the words within the term.

EXPLORER SATELLITES	EXPLORER SATELLITE
R- 100 AIRCRAFT	F-100 AIRCRAFT
F-1 ROCKET ENGINE	F- 1 ROCKET ENGINE
L-29 JET TRAINER	L- 29 JET TRAINER

This pattern of construction, i.e., multiple spacing between the parts of a term, refer to various engines and aircraft. Although the term may duplicate the name of the engine or aircraft, this is not the purpose

of an index term. In these cases, which include variable numbers of blank spaces between the parts of a term, the compilers of the Thesaurus have confused the name of an object with an index term which need only represent the name of the object, not duplicate it.

D. Glossed Terms

Glossed terms are those that fit the following configurations:

_____ ( ) or _____ ( ) _____ in the Thesaurus

_____ / / or _____ / / _____ in the SAL

where the blank represents a word or phrase followed by an additional word or phrase bounded by parentheses or slashes, and sometimes followed by another word or phrase.

The gloss has been used four different ways in the Thesaurus

1. to assign the field when the same word may have been used as a term in several fields, e.g.,

   AGING (BIOLOGY)
   AGING (METALLURGY)

2. to eliminate ambiguity when a homonym is used in more than one context, e.g.,

   WEBS (MEMBRANES)
   WEBS (SHEETS)
   WEBS (SUPPORTS)

3. To add to a term the acronym or initialism by which it is also known, e.g.,

   ADENOSINE DIPHOSPHATE (ADP)

4. to add the word "Trademark" or "Tradename" to the term when such an assignment is appropriate, e.g.,

   BAKELITE (TRADEMARK)

In each case, the gloss becomes an integral part of the term.

Used to Indicate the Field

The gloss is frequently used in the Thesaurus to indicate the field to which the term has been assigned when the term is a homonym and may be used in several fields with different referents, e.g.,

PRECIPITATION (CHEMISTRY)
PRECIPITATION (METEOROLOGY).

The comparable configuration used in the SAL is bound by slashes rather then parentheses, i.e.,

TERM /GLOSS/,

and is used relatively infrequently. A term glossed in this way, by field, appeared sixty-one times in the sample of Thesaurus terms. In only ten cases were the equivalent SAL terms glossed. The gloss,

_____ /BIOL/ [biology],

was used eight times, and the gloss,

_____ /MATH/ [mathematics],

was used twice. However, it was possible to substitute SAL terms in seventeen cases because when one form of the term was glossed in the SAL, it was assumed that the unglossed form was the equivalent of the glossed Thesaurus form, when both forms in the Thesaurus were glossed. For example, the unglossed SAL term

FATIGUE

was substituted for the Thesaurus term

FATIGUE (MATERIALS)

because the only other form of the term in either the Thesaurus or the SAL was a glossed form, i.e.,

FATIGUE (BIOLOGY)

In the Thesaurus, and in the SAL

FATIGUE /BIOL/.

In eight cases both the SAL term and the Thesaurus term were glossed. For two terms in the SAL the word used as a gloss in the Thesaurus differed from the SAL term, but the words used as a gloss were closely

enough related in meaning to make the substitution possible.

Thesaurus	SAL
PLANTS (BOTANY)	PLANT /BIOL/
SKIN (ANATOMY)	SKIN /BIOL/

In only two instances was the SAL term glossed and the Thesaurus term unglossed:

Thesaurus	SAL
INEQUALITIES	INEQUALITY /MATH/
BODY TEMPERATURE	BODY TEMPERATURE /BIOL/

The application of the second term (above) is delimited by the use of a negative gloss in the Thesaurus:

SKIN TEMPERATURE (BIOLOGY)	SKIN TEMPERATURE /BIOL/
SKIN TEMPERATURE (NON-BIOLOGICAL)	SKIN TEMPERATURE

Twenty-three terms were glossed in the Thesaurus and not glossed in the SAL. In eighteen cases, the glossed form was the only form appearing in the Thesaurus and was therefore believed to be the equivalent of the SAL form. In another five cases, in the opinion of one familiar with the file, little ambiguity would result if the unglossed SAL form of the term were equated to the glossed Thesaurus term. A list of the terms glossed in both the Thesaurus and SAL appears in Appendix B, page 188.

It was impossible to relate twenty-four of the glossed Thesaurus terms to the unglossed SAL term because of the potential for ambiguity in the unglossed SAL form.

A list of these terms may be found in Appendix B, page

By Initialism

The SAL used a gloss of the first type very infrequently and almost never used a gloss of the second type. However, a gloss of the third type was used almost invariably in the SAL when such an acronym or initialism

was available. A comparable configuration is seldom used in the Thesaurus. This configuration was used one hundred and eighteen times in the sample of SAL terms. The equivalent Thesaurus term had no gloss although in each case there was an access entry from the initialism or acronym to the legal term. In the following list of examples, the Thesaurus term precedes the SAL form:

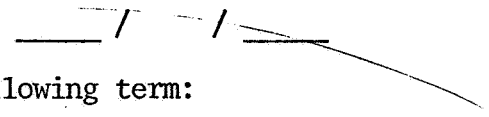
ALTERNATING CURRENT
ALTERNATING CURRENT /AC/

ARITHMETIC AND LOGIC UNITS
ARITHMETIC AND LOGIC UNITS /ALU/

BALLISTIC MISSILE EARLY WARNING SYSTEM
BALLISTIC MISSILE EARLY WARNING SYSTEM /BMEWS/

Ninety-eight of the terms have the above configuration, i.e., the initialism or acronym is at the end of the term.

In nine cased the initialism or acronym is enclosed within the term in the following configuration:



as, for example in the following term:

CONTINUOUS WAVE /CW/ RADAR

The equivalent Thesaurus term does not include a gloss but in each case an access entry is made for the initialism that refers to the legal entry.

In one case, the term in the Thesaurus includes a gloss, ADENOSINE DIPHOSPHATE (ADP) and the equivalent term in the SAL does not. This may be a correction of the earlier SAL term, since for a similar term, ADENOSINE TRIPHOSPHATE, both include a gloss (ATP) and /ATP/ respectively.

In three examples, the terms in both the Thesaurus and SAL include a gloss:

ADVANCED VIDICON CAMERA SYSTEM (AVCS)
ADVANCED VIDICON CAMERAL SYSTEM /AVCS/

LOGISTICS OVER THE SHORE (LOTS) CARRIER
LOGISTICS OVER THE SHORE /LOTS/ CARRIER

DEFENSE COMMUNICATIONS SYSTEM (DCS)
DEFENSE COMMUNICATIONS SYSTEM /DCS/

However, only the first example has an access entry in the Thesaurus for the initialism.

For three terms, the Thesaurus includes neither the gloss as part of the term nor an access entry for the initialism.

In one case, the Thesaurus term includes the acronym but not as a gloss:

ASTEC SOLAR TURBOELECTRIC GENERATOR
ADVANCED SOLAR TURBOELECTRIC CONVERSION /ASTEC/

These two terms may not be related. However, that seems unlikely since both include the acronym as part of the term and there is an access entry for TURBOELECTRIC CONVERSION referring to TURBOGENERATORS. A complete list of the Thesaurus terms and SAL equivalents in this category appears in Appendix B, beginning on page 173.

In some cases the legal entry in the Thesaurus is the acronym with a "Use" reference from the full term. This is in accordance with the statement in the preface, "Abbreviations and acronyms that are in common use in the aerospace community are employed in the Thesaurus."[47] There are thirty-two acronyms used in the sample of Thesaurus terms as legal entries. The acronym is usually also found in the SAL. However, in seven cases the form of the term in the SAL differs from the form used in the Thesaurus. In the following list, the first term is the same in the SAL and Thesaurus:

---

[47]NASA Thesaurus, I, v.

Thesaurus	SAL
LOCATES SYSTEM	LOCATES SYSTEM
MATTS (SYSTEMS)	MATTS
MINITRACK SYSTEM	MINITRACK
PERT	PERT PROJECT
RAMIS (SYSTEM)	RAMIS SYSTEM
SHORAN	SHORAN DISTANCE
*DAMP PROGRAM	DAMP
SNAP	SNAP PROGRAM
STADAN (SATELLITE TRACKING NETWORK)	STADAN
SLAM SUPERSONIC LOW ALTITUDE MISSILE	SLAM MISSILE

In checking these terms, in the SAL as the authority because delimiting the term to forty-two characters as is done in the Thesaurus sometimes leaves an incomplete term, it was found that in the first term, the word "system" is not represented in the acronym. "System" is represented in the second, third and fourth acronym. "Program" is represented in "DAMP" but not in "SNAP". As can be seen from this list, not only are there inconsistencies in the formation of terms in the SAL but there are apparently no rules for the formation of this type of term in the Thesaurus.

By Context

A gloss is frequently used in the Thesaurus to eliminate ambiguity when a term is used in more than one context. For one hundred and four legal terms and twenty-nine access entries of this type, no SAL term could be related because the term was ambiguous as it appeared in the SAL, in an unglossed form. A list of these terms appears in Appendix B, pages 189-193.

Forty-seven Thesaurus legal terms and thirty-two access entries glossed in this way appeared in only one form in the Thesaurus and the decision was made to equate them with the unglossed SAL term. This

decision may have been incorrect because implicit in the gloss is the possibility of ambiguity in the application of the term. For example, the word "anchors" appears only in the term

ANCHORS (FASTENERS)

in the Thesaurus, and in the unglossed, singular form in the SAL, i.e.,

ANCHOR.

The SAL form was therefore substituted for the Thesaurus form. There is no evidence to the effect that the term was used for only that referent during the period the SAL was in effect.

Thirteen of the access entries were glossed by the legal, referred-to term, e.g.,

ADDITIVES Used For *DOPING (ADDITIVES).

Ten of the access entries were glossed by one word of the referred-to legal term, e.g.,

ELECTRIC CHOPPERS Used For *CHOPPERS (ELECTRIC).

In every case, the most closely related SAL term appears in an unglossed form and in the singular, e.g.,

Thesaurus	SAL
*DOPING (ADDITIVES	DOPING
*CHOPPERS (ELECTRIC)	CHOPPER

Only six SAL terms in the sample were glossed in this way, i.e., to differentiate among several contexts, and only two different words were used for the gloss, "planet" and "metal." All of the terms naming planets were glossed in the form found in the SAL.

Only one metal was glossed in the SAL, i.e.,

MERCURY /METAL/.

The Thesaurus forms of these terms and the equivalent SAL terms are in

Appendix B, page 180.

By "Trademark"

Twenty-seven of the Thesaurus terms were glossed with the word "trademark" and one with "tradename". There was no problem in relating these terms to the appropriate SAL term even though the SAL term was unglossed, because each term was unique.

CHAPTER VIII

THE EFFECT OF THE DIFFERENCES IN TERMINOLOGY UPON THE STRATEGIES

One way of assessing the applicability of the Thesaurus to the retrospective file is by comparing the two sets of terms on a term by term basis, as has been done in previous chapters. A second step in this process is determining the effect of the differences in the terminology and the structure of the Thesaurus upon the strategies used during the sample period.

The SAL terms used in the strategies during the sample period were coded to show the effect of converting the terms to a form appropriate for the Thesaurus. There were three categories of terms that appeared in the first term conversion process, (1) those that did not appear in the Thesaurus, (2) those that appeared in the Thesaurus as access entries, and (3) those that were found as exact matches, plurals, or with some other modification of form in the Thesaurus.

Although less than 10 per cent of the SAL terms could not be equated with the Thesaurus terms, 124 strategies, almost 48 per cent of the 256 strategies, included terms in this category. These terms, therefore, did not appear in the converted strategies.

The remaining terms in the strategies were converted to a form suitable for searching the current file by changing the terms to conform to the Thesaurus form of the term and substituting the legal terms for access entries.

The assumption is not being made that this is the strategy the

analyst would necessarily write for searching the current file. The problems in converting to a strategy suitable for searching the retrospective file would be the same.

If the strategies are now reconverted to a form suitable for searching the file of SAL indexed documents and are compared to the original strategies, the magnitude of the change in terminology becomes apparent. The following information appears in tabular form in Table 3, page 113.

Only twelve, 4.7 per cent, of the strategies revert to their original form. The only rule discovered in the comparison of SAL and Thesaurus terminology of general enough applicability to be useful is that of changing the Thesaurus plural form to the SAL singular. If this rule is applied, an additional thirty-five, 13.2 per cent, of the strategies revert to their original form.

In an additional twenty-one strategies, 8.2 per cent, the difference between the original strategy and the reconstructed strategy depended upon a term for which the difference between the SAL form and the Thesaurus form was such that no rules could be written that would make it possible to change to the SAL form without referring to the SAL for verification of the term.

All of the remaining strategies in their original form include either access entries, sixty-four strategies (25 per cent) or SAL terms not in the Thesaurus, forty strategies (15 per cent), or both categories of terms, eighty-four strategies (32 per cent).

The Effect of the Thesaurus on the SAL Strategies

Thesaurus Modification of the Terms	Number of Strategies Affected
All the terms in the strategy:	
A. Exactly match Thesaurus form	12 (5%)
B. Are singular form of Thesaurus plural form or exactly match	35 (13%)
C. Includes terms that differ in some way other than simply by number and A and/or B above	21 (8%)
D. Includes Access Entries as well as A or B or C above	64 (25%)
E. Includes terms not in the Thesaurus as well as A or B or C above	40 (15%)
F. Includes Access Entries and terms not in the Thesaurus as well as A or B or C above	84 (32%)
Total	256 (98%)

Table 3

In 101 cases, affecting sixty-six strategies, 25.7 per cent, the legal term referred to by the access entry was not in the SAL. There is no way to discriminate between those access entries for which the legal term is not in the SAL, such as

PROJECT MANAGEMENT

which does not appear in the SAL although the access entry does, i.e.,

PROGRAM MANAGEMENT,

and those access entries for which both legal and access entry appear in the SAL, such as

AIRCRAFT CONSTRUCTION use AIRCRAFT STRUCTURE (S)

There is no way to tell from either an examination of the term or the structure of the Thesaurus whether a term appears in the SAL and if it does, the form in which it appears.

It was assumed that the access entries would retrieve a different set of documents from those retrieved by the referred-to legal term. This proved to be the case in the small sample tested. In a sample of sixteen strategies that included both access entries and terms that did not appear in the Thesaurus, a comparison was made of the documents retrieved by the original strategy with those retrieved by a strategy modified by the Thesaurus. The methodology for this comparison follows.

Comparison of the Original Strategy with Reconverted Strategy

After converting the terms in the strategies to the form found in the Thesaurus, the Thesaurus form of the term was substituted in the strategies. For example, the following strategy is in its original form.

LAMINATED MATERIAL + LAMINATION + SANDWICH + SANDWICH CONSTRUCTION + REINFORCED MATERIAL + REINFORCED PLASTIC + REINFORCING FIBER

In the following, the SAL form of the term is in the column on the left and the equivalent term from the Thesaurus, in the column on the right. Terms that appear as access entries in the Thesaurus are marked with an asterisk.

SAL		Thesaurus
*LAMINATED MATERIAL	Use	LAMINATES
*LAMINATION	Use	LAMINATES
SANDWICH		Not in the Thesaurus
*SANDWICH CONSTRUCTION	Use	SANDWICH STRUCTURES (not in the SAL)
*REINFORCED MATERIAL	Use	COMPOSITE MATERIALS
REINFORCED PLASTIC		REINFORCED PLASTICS
REINFORCING FIBER		REINFORCING FIBERS

When the legal Thesaurus terms are combined, the following strategy is the result.

LAMINATES + SANDWICH STRUCTURES + COMPOSITE MATERIALS + REINFORCED PLASTICS + REINFORCING FIBERS

As can be seen in the preceeding strategy, the term "Sandwich" was lost when the strategy was converted to the Thesaurus form. An additional four terms in the strategy appeared as access entries in the Thesaurus with references to the legal terms. The legal terms were substituted in the strategy.

The rules for converting Thesaurus terms to the form in the SAL were now applied and the resulting strategy used to search the retrospective file. A comparison was made of the documents retrieved by the original strategy with those retrieved by the reconverted strategy. This made it possible to estimate the value of the deleted entries and the access entries to the retrospective file.

The data for this strategy appear in the following chart.

	Original Strategy	Reconverted Strategy
Total Retrieved	37	24
Total Relevant/Analyst	23	17
Total Relevant/User	23	17
Not Retrieved/Relevant	06	

If the access entries are added to the reconverted strategy, an additional twelve documents are retrieved, two of them relevant. Apparently the term SANDWICH was responsible for the remaining four related documents not retrieved by the reconverted strategy.

This process was repeated for sixteen strategies selected from the set of strategies that included either access entries or SAL terms that did not appear in the Thesaurus. No record was kept of newly cited documents that resulted from the inclusion in the strategy of referred-to legal terms that did not appear in the original strategy. Because of the time that had passed since the sample period, it was not possible to have newly-cited documents evaluated. Fifteen of the strategies included access entries and five included terms not in the Thesaurus. The data from the sixteen strategies appear in the following table.

	Retrieved By Original Strategy	Retrieved By Reconverted Strategy
Total Retrieved	468	350 (74.7%)
Total Relevant: Analyst	220 (47% of the total retrieved)	178 (80.9% of total relevant)
Relevant: Not Retrieved		42 (18% of total relevant)
Retrieved by Access Entries		30 (13.6% of total relevant)
Retrieved by Deleted Terms		12 (5.4% of total relevant)

This is too small a sample to be more than indicative. Apparently the access entries should be included in the strategies when the strategy developed for the current file is converted for searching the retrospective file. However, the access entries do not match the SAL form of the term, nor do all the access entries appear in the SAL.

CHAPTER IX

CONCLUSIONS

One of the objectives of this study was the development of a set of rules that would enable the user to translate the terms in the strategies from the form found in the Thesaurus to the form found in the SAL without constant referral to the SAL for verification of the term so that the term relationships displayed in the Thesaurus could be utilized for searching the SAL indexed file.

The assumption was made that the content of the file acquired before the publication of the Thesaurus would closely resemble that acquired after the publication of the Thesaurus and that therefore the sets of terms used to describe the file would resemble one another closely.

In order to derive a set of terms of particular applicability to the subject areas of interest to the Pittsburgh RDC, the strategies in effect during one retrospective search period were used as the data base. The terms from the strategies were used to develop a subset of the Thesaurus. The terms in this subset were then converted to a form acceptable to the retrospective file.

The major portion of this study is devoted to a comparison of the two sets of terms, those from the Thesaurus and those from the SAL, in an attempt to develop an algorithm that would make possible the conversion of the Thesaurus form of the term to the form found in the SAL.

Although most of the terms in the sample of terms from the Thesaurus were found in the SAL, the anomalies that appeared when the two sets were

equated, invalidated any attempt to relate the two sets of terms in any systematic way.

The Matched Terms

Almost 79 per cent of the Thesaurus terms were either exactly matched in the SAL or were the plural form of the SAL singular form. For another 10 per cent of the Thesaurus terms, there were equivalent SAL terms but the difference between the two forms was other than simply one of number, although there might also be a difference in number between the two forms. That there were apparently no rules for the construction of terms in the SAL can be clearly seen when the SAL terms are compared with one another and with a set of terms from the Thesaurus whose construction has, to some degree, depended upon rules and conventions established for the construction of terms. Therefore, even though most of the Thesaurus terms could be matched in the SAL, because of the anomalies that appeared in 10 per cent of the terms and because 11 per cent of the terms in the Thesaurus were unmatched in the SAL, it was impossible to predict from the form of the term in the Thesaurus whether the term would appear in the SAL and if it did, the form in which it would appear.

The "Used For" Structure

Although an analysis of a small number of strategies seems to indicate that the access terms must be used when a strategy written for the current file is converted to a form suitable for the retrospective file because more than half of the strategies included access entries, the access entries in the Thesaurus do not always match the form of the term in the SAL nor are all the access entries in the SAL. Therefore, there is no way to predict from the structure of the Thesaurus whether a term is

in the SAL and if it is, the form in which it will appear.

The Unmatched Terms: SAL to Thesaurus

Although less than 10 per cent of the SAL terms in the strategies were not found in the Thesaurus, these terms were used in 48 per cent of the original strategies developed for searching the SAL file. There is apparently no way in the Thesaurus to compensate for the loss of these terms. Therefore, the development of strategies for searching the retrospective file will depend upon the analyst's knowledge of the structure of the file because that structure is apparently not represented in the Thesaurus.

The Unmatched Terms: Thesaurus to SAL

Although only 11 per cent of the terms in the Thesaurus could not be found in the SAL, there is no way to tell from an examination of the term or the structure of the Thesaurus that the term is not in the SAL. The largest set of unmatched terms from the Thesaurus were those that were glossed either by field or by context. Because the SAL terms were infrequently glossed in this way, only the Array Term, when the glossed term also appeared in that form, could be equated with the SAL term. Almost half the strategies included a term that appeared in the Thesaurus as an Array Term. To equate the Array Term with the SAL term destroys the discriminatory effect of the Thesaurus because, in the Thesaurus, the Array Term is used to indicate that the term is ambiguous, either as a term or in an unglossed form.

The Two Systems

From this analysis, it seems clear that although a majority of the

Thesaurus terms in the sample appear in the SAL, there are really two different indexing systems involved. The system reflected in the Thesaurus is an enumerative one, in which each aspect is listed separately in a pre-coordinated term. The system in the SAL, although it also included pre-coordinated terms, depended upon the post-coordination of terms for the removal of ambiguity and the development of strategies. Although the Thesaurus is, to some degree, applicable to the SAL file, the set of documents retrieved by the original strategy will not be retrieved by a strategy based on the enumerative system of the Thesaurus.

"Interdisciplinary" Thesauri

There are several alternatives available when a thesaurus is superimposed on an information system whose indexing was originally based on another approach to vocabulary control.

1. The files can be kept separate and subject approach to the files controlled by the two separate authority lists.
2. The documents indexed by the original authority list can be reindexed to conform to the new authority list
3. The new authority list can be coded in some way to show the relationships between the terms on the original list and those on the new so that access to both files can be made from one list.
4. Another alternative possible is the development of a thesaurus based on the original authority list that would eliminate coping with the sort of anomalies that appear when the terms in the SAL and the current Thesaurus are compared. This would simply have perpetuated the ambiguity of the terminology used during the period the SAL was in effect, and may not have been possible because the objective of the compilation of the Thesaurus, as it relates to Project Lex, was apparently the development of an interdisciplinary authority list applicable to a large group of federal information systems.

In a comparison made of the indexes to a set of documents which were indexed separately by two large information systems, DDC and NASA, it was found that only 60 per cent of the terms available to both systems were used by both systems to index the common set of documents. The author

continues by saying that "while a comparison of indexing practices is interesting, the real test, of course, lies in actual retrieval. To measure the true effectiveness of using equivalents, formed at the verbal level - or as directed by a thesaurus - for simultaneous machine searching of two collections, will require an evaluation under operational conditions, rather than continued study or experimentation. I do not predict much success."[48]

Therefore, establishment of a common vocabulary may still not make the results of indexing interchangeable among the large information systems to which the Project Lex thesaurus was intended to apply.

Thesaurus Development and Search Strategies

One of the most important parts of the design of an information system is the development of the vocabulary to be used in the indexing of the documents acquired. By establishing the terminology, retrieval is limited to those aspects reflected in the terms. The terminology used in information systems has frequently been established on an empirical basis, i.e., a limited number of documents are indexed, an analysis made of the terminology used, variant forms and synonyms eliminated and the resulting vocabulary used as a basis for indexing documents in that system. The list of terms may then be organized into a thesaurus based either on some associative value among the terms or upon a consensus of opinion among experts in the field and/or users of the system, or both techniques may be used in combination. The compilers of thesauri have been described

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[48]William Hammond, "Dimensions in Compatibility," in Information Systems Compatibility, ed. Simon M. Newman, (N. Y. Spartan Books, 1965), p. 13.

as those who "take refuge . . . behind a barricade of more or less synonymous words, which is much as if one should nail up a number of 'No Trespassing' signs on a post in the center of his property but none along the borders."[49] If this is true, a thesaurus is primarily designed for indexers who can assign to the document the index term that most closely resembles the word used in the text. There can be no other reason for some of the subterms that appear, for example, under

DURABILITY

as "Related Terms" in the Thesaurus, i.e.,

LIFE (DURABILITY)
RUGGEDNESS
WEAR.

It seems unlikely that the user would be able to discriminate between

LIFE (DURABILITY) and DURABILITY

although the indexer would probably select the term most nearly like the word that appeared in the text. This proliferation of terms all applicable to the same referent diminishes the potential for search strategies based on the coordination of terms.

A useful approach to thesauri, from the viewpoint of searching the file, would be the modification of a thesaurus based on an analysis of the relationship of the terms in strategies to one another compared with their relationship as displayed in the thesaurus. The analyst or user of a file is as much in need of a tool for retrieval as is the indexer in need of an authority list. The developemnt of most thesauri have so far been usually based entirely on the documents indexed. Because of the number of terms used in indexing systems and the number of relationships among them, no

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[49]Louis B. Salomon, Semantics and Common Sense, (N. Y.:Holt, Rinehart and Winston, Inc., 1966), Footnote, p. 41.

associative technique will entirely reflect the structure of the file.

This was suggested some time ago, when one information system in the process of consolidating the thesauri used within the system, sorted the terms into categories similar to those used in the Thesaurus Rules and Conventions of Project Lex. At the same time, the terms in the strategies used for a computer search of the file were analyzed according to category and it was found that "devices, qualities, materials and processes represented 90 per cent of the different concepts involved."[50] An analysis of this sort was not made of the strategy terms used in this study. Such an analysis should utilize strategies designed for the current file and take into consideration the usefulness of the categories and subcategories for expanding searches and the hierarchical arrangement as well as the kinds of terms employed in the strategies.

A Note on Finding Equivalent Classes of Terms

The original assumption made was that the Thesaurus incorporated, with minor modifications and deletions, the terms from the SAL. This did not prove to be the case. The systems were not isomorphic and therefore had to be viewed as two different linguistic systems. The terms omitted from both sets represented classes of terms, i.e., term fragments from the SAL which appeared as adjectival forms did not appear in the Thesaurus and the variant forms of one word used in the Thesaurus to apply to different referents could not be equated to a term in the SAL.

The assumption was then made that since both systems referred to the

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[50]Robert F. Schirmer, Thesaurus Analysis for Updating, pp. 3-4, (Information Systems Division, Secretary's Department, E. I. Du Pont De Nemours & Co., Inc., Wilmington, Delaware, March 24, 1966).

same file, an attempt should be made to find equivalent classes whenever possible. Equivalency was based on the morphology of the terms rather than their use in the system in that terms in the nominal form that were used both as single units and as fragments of multiple word terms in the SAL were equated with the Thesaurus term even though the term would not appear in the Thesaurus based document indexes as a term fragment.

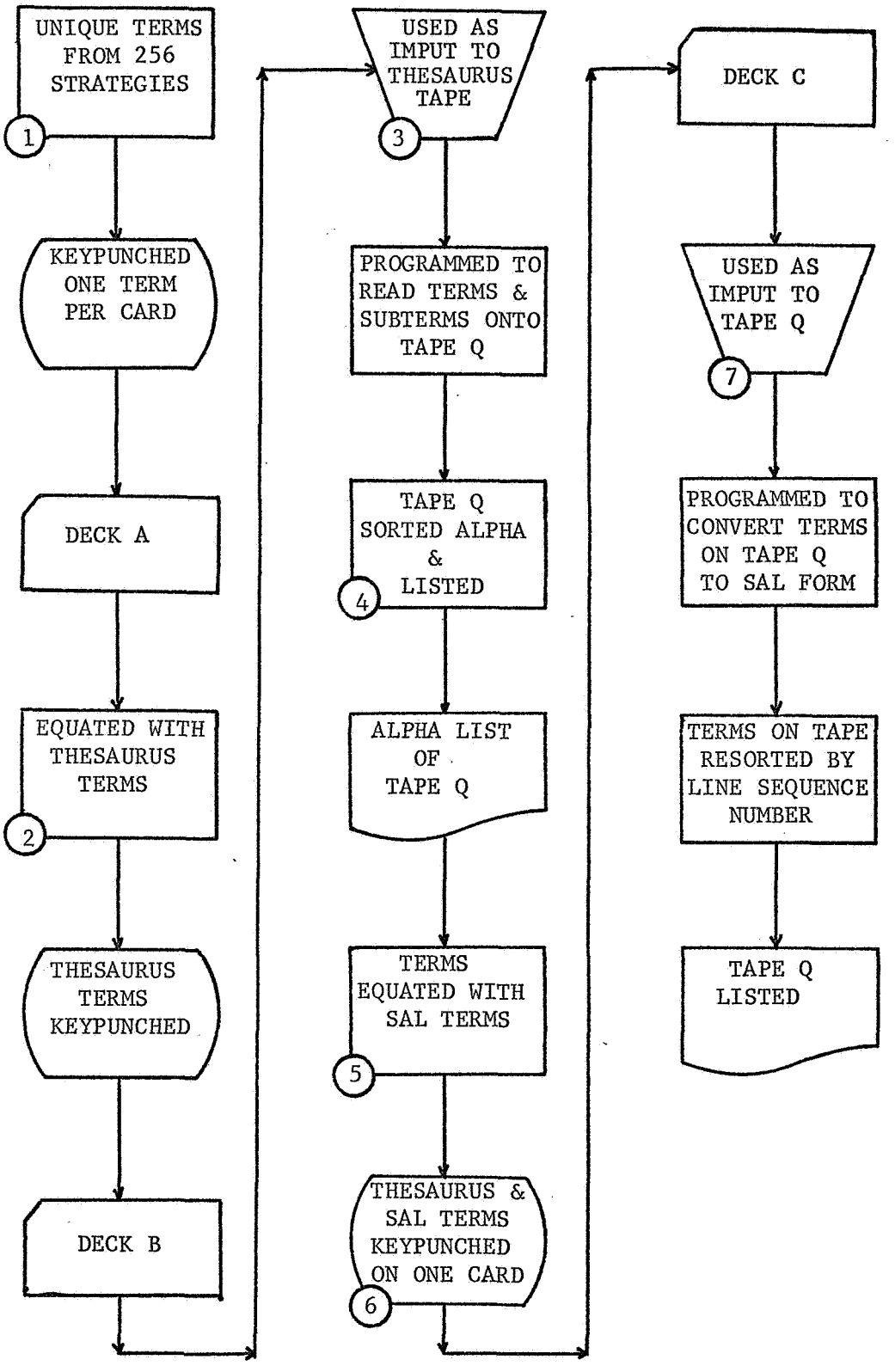
Because the original objective was the development of a set of rules that would enable the user to translate from one authority list to the other, the emphasis has been on those classes of terms in the two sets that were different from one another rather than upon those which were alike. For that reason the end result has been a contrastive grammar which provides a description of each language in terms of its difference from the other.

APPENDIX A

The Process

When this study was first planned, it was believed that there would be a relatively small number of unique terms in the total number of terms used in the strategies and that it would be possible to visually equate the subterms listed under the strategy terms as Main Terms in the Thesaurus with the SAL form of the term and keypunch the SAL term for a single aspect search of the file. The unexpectedly large number of unique terms used in the strategies precluded this possibility and it was necessary to mechanize more of the project than had originally been planned. The numbers preceding the following paragraphs refer to appropriate parts of the schematic, Figure 9, page 128.

1 The terms in the strategies delimited in Chapter IV were keypunched, one term per card, Deck A, and sorted alphabetically in order that the unique terms might be selected. 2 The unique terms were converted to the Thesaurus form of the term as recorded in Chapter V and the resulting Thesaurus terms were keypunched, one term per card. This deck, Deck B, consisted of approximately 1500 unique terms. This set of terms does not exactly match the strategy terms discussed in Chapter V. In addition to those terms in the strategies for which relevance information had been returned by the user, the terms in all the strategies for which there was any feedback from the user relating to computer cited documents were included. Some of the returned relevance sheets included only document orders and were later deleted from the sample.



SCHEMATIC OF PROCESS

Figure 9

Relevance sheets for several strategies had not been returned by the users at the time the search was made of the files for the sample strategies. The terms from these strategies were later added to the sample but do not appear in the subsequent comparison of SAL and Thesaurus terminology.

3 The Knowledge Availability Systems Center has a copy of the Thesaurus on computer tape. Deck B was used to read from the computer tape of the Thesaurus onto another tape, all of the strategy terms as Main Terms and their appropriate subterms.

The Thesaurus is recorded on the computer tape as it appears in the first two volumes of the published Thesaurus, i.e., alphebetically by Main Term followed by subterms arranged alphabetically within the categories, "Used For," "Broader," "Narrower," and "Related."

One logical record equalled one 109 character record positioned in ten fields. Only four of the fields were necessary to this project and they were located in the following positions:

Field	Position	Content
I	1-7	a line sequencing number
II	8	a term relationship code
III	25-66	a 42 character subterm field
IV	67-108	a 42 character Main Term field

The Main Terms and the appropriate subterms were read from the taped Thesaurus onto another tape by matching the terms in Deck B, the Thesaurus form of the original strategy terms, with the terms in Field IV. When the term in Field IV matched the term on the card, the logical record was read onto another tape. When the terms no longer matched, the succeeding card was read from Deck B and the program continued to search in Field IV until all of the terms in Deck B had been matched with a term

in Field IV and all of the subterms had been read onto another tape, Tape Q.

4 This second tape, Tape Q, comprising a subsetof the Thesaurus, was sorted alphabetically by the terms in Field III, the subterms, and listed. Figure 9, page 128, is a copy of one of the sheets of this list. This resulted in a list of approximately 22,000 terms of which 8,000 were unique.

5 Each unique term was then compared visually with the terms in the SAL. The results of the comparison are recorded in Chapter VII.

6. When an SAL term could be equated to the Thesaurus term on the alphabetized listing of Tape Q, both terms were keypunched on one card: the form found in the Thesaurus in the first 40 columns and the form found in the SAL second 40 columns. It was unnecessary to keypunch a card for those terms that exactly matched in the Thesaurus and SAL. When there was no term in the SAL that could be equated to the Thesaurus term, the Thesaurus term was keypunched in the first 40 columns and again in the second 40 columns of the card but prefixed in this case by a dash (-) in column 41.

7 This deck, Deck C, was used to substitute the SAL term for the Thesaurus term when there was a difference between the two forms, or to place a dash before the Thesaurus term if no equivalent term could be found in the SAL. After Tape Q had been modified by Deck C, Tape Q was re-sorted by line sequence number and listed. This provided the SAL form of the term in the display of terms afforded by the Thesaurus. (See Figure 10, page 131)

The deck, Deck C, that had been used to make the term substitutions on Tape Q was then used to create a deck (Deck D) for making single aspect searches of the sample period. The cards with a dash (-) in column 41 were sorted out of the deck since these terms did not appear in the SAL.

The search program used at the University of Pittsburgh RDC requires that the strategy term begin in column one and limits the number of

194921	CESIUM COMPOUND	CESIUM COMPOUNDS
194946	CESIUM ANTIMONIDE	CESIUM COMPOUNDS
194956	CESIUM BROMIDE	CESIUM COMPOUNDS
194966	CESIUM FLUORIDE	CESIUM COMPOUNDS
194976	CESIUM HALIDE	CESIUM COMPOUNDS
194986	CESIUM HYDRIDE	CESIUM COMPOUNDS
194996	CESIUM IODIDE	CESIUM COMPOUNDS
195006	CESIUM OXIDE	CESIUM COMPOUNDS
195017	-ALKALI METAL COMPOUNDS	CESIUM COMPOUNDS
195027	METAL COMPOUND	CESIUM COMPOUNDS
195037	METAL FUEL	CESIUM COMPOUNDS

195211	CESIUM FLUORIDE	CESIUM FLUORIDES
195235	ALKALI HALIDE	CESIUM FLUORIDES
195245	CESIUM COMPOUND	CESIUM FLUORIDES
195255	CESIUM HALIDE	CESIUM FLUORIDES
195265	FLUORIDE	CESIUM FLUORIDES
195275	FLUORINE COMPOUND	CESIUM FLUORIDES
195285	HALIDE	CESIUM FLUORIDES
195295	HALOGEN COMPOUND	CESIUM FLUORIDES
195305	METAL HALIDE	CESIUM FLUORIDES

195311	CESIUM HALIDE	CESIUM HALIDES
195335	ALKALI HALIDE	CESIUM HALIDES
195345	CESIUM COMPOUND	CESIUM HALIDES
195355	HALIDE	CESIUM HALIDES
195365	HALOGEN COMPOUND	CESIUM HALIDES
195375	METAL HALIDE	CESIUM HALIDES
195386	CESIUM BROMIDE	CESIUM HALIDES
195396	CESIUM FLUORIDE	CESIUM HALIDES
195406	CESIUM IODIDE	CESIUM HALIDES

Figure 10

characters for any one term to twenty-one. A third requirement is that each strategy be preceded by a card which has a unique (to that run of the tape) number in the first five columns.

A program was written for the IBM Computer Model 1130 that read columns 41 through 61 on Deck C and punched a card with those characters in columns one through 21 on a new card. The IBM Model 1130 was also used to create the preliminary cards for the strategies, a deck of 2,500 sequential five digit numbers.

The IBM Computer Model 360-20 was used to interfile the term cards with the preliminary number cards, the search deck, and to list this deck, Deck D. This listing was necessary because the strategy terms do not appear on the computer printout of the search results. Only the unique number on the preliminary card appears and the only way to assign the printout of the search results to the appropriate term (strategy) is by the number used on the preliminary card.

There were two kinds of terms not in Deck C, the conversion deck, because it had been unnecessary to keypunch conversion cards for them.

1. terms that were exact matches in the SAL and Thesaurus did not need a conversion card because they remained the same on Tape Q.
2. access entries for terms appearing only as subterms on Tape Q did not appear on Tape Q and consequently no conversion cards were keypunched for them.

Terms that were exact matches in the SAL and Thesaurus were keypunched and added to the search deck.

The access entries for terms that were not Main Terms in the subset of the Thesaurus posed a greater problem. Each unique term appearing in the alphabetical listing of Tape Q had to be checked as a Main Term in

the published Thesaurus in order to determine whether it had access (Used For) entries appearing as subterms. When this occurred, both terms were keypunched on the same card, the legal term in columns one through 38 and the access entry in columns 41 through 78. The unused columns were reserved for coding. This deck, Deck E, was sorted alphabetically by the access entry, beginning in column 41, and listed.

Alphabetizing by access entry was necessary to facilitate searching for the term in the SAL. When an equivalent term was found in the SAL, it was keypunched and added to the search deck.

Each search consisted of approximately one hundred and fifty single aspect strategies. After the search was completed, the strategy number cards and the term cards were separated on the sorter. The strategy number cards were then coded, beginning in column seven, and were reused in subsequent searches.

The deck of term cards was reproduced and the computer printout of the document accession numbers cited for the strategy was fastened to the appropriate card.

Deck C, the conversion deck on which were keypunched both the SAL and Thesaurus forms of the terms, and Deck E, the deck of access entries, were sorted manually and the terms categorized by the kind of difference between the SAL and Thesaurus forms of the terms. The results of that analysis appear in Chapters VI and VII.

All of the single aspect searches that were made were not used in this study. Only a very small number were used. The results of the other single aspect searches were used in another study. However, the complete process has been described because those used in this study were not searched separately but were part of the total searched.

APPENDIX B

The Two Sets of Terms

AVIAN 2/180 AUTOGIRO	AVIAN 2/180 AUTOGYRO
WA-116 AUTOGIRO	WA-116 AUTOGYRO
BAYARD-ALPERT IONIZATION GAGES	BAYARD-ALPERT IONIZATION GAUGE
CAPACITIVE FUEL GAGES	CAPACITIVE FUEL GAUGE
FUEL GAGES	FUEL GAUGE
IONIZATION GAGES	IONIZATION GAUGE#ION GAUGE
MCLEOD GAGES	MCLEOD GAUGE
PENNING GAGES	PENNING GAUGE
PIRANI GAGES	PIRANI GAUGE
PRESSURE GAGES	PRESSURE GAUGE
RAIN GAGES	RAIN GAUGE
SPUTTERING GAGES	SPUTTERING GAUGE
STRAIN GAGES	STRAIN GAUGE
STRAIN GAGE ACCELEROMETERS	STRAIN GAUGE ACCELEROMETER
STRAIN GAGE BALANCES	STRAIN GAUGE BALANCE
VACUUM GAGES	VACUUM GAUGE
MACH-ZENDER INTERFEROMETERS	MACH-ZEHNDER INTERFEROMETER
SIPHONS	SYPHON
THERMOSIPHONS	THERMOSYPHON
*GAGES	GAUGE
*ION GAGES	ION GAUGE
*CEPHALAGIA	CEPHALALGIA

EXPLORER 22 SATELLITE	EXPLORER XXII SATELLITE
MIRAGE 3 AIRCRAFT	MIRAGE III AIRCRAFT
OSO- 1	OSO- I
OSO- 2	OSO- II
SKYDART 2 ROCKET VEHICLE	SKYDART II ROCKET
SPARROW 2 MISSILE	SPARROW II MISSILE
SPARROW 3 MISSILE	SPARROW III MISSILE
TITAN 2 ICBM	TITAN II ICBM
TITAN 1 ICBM	TITAN I ICBM
TORY 2 REACTOR	TORY II REACTOR
TORY 2-A REACTOR	TORY II-A REACTOR
TRANSIT 1A SATELLITE	TRANSIT IA SATELLITE
TRANSIT 1B SATELLITE	TRANSIT IB SATELLITE
TRANSIT 2A SATELLITE	TRANSIT IIA SATELLITE
TRANSIT 3B SATELLITE	TRANSIT IIIB SATELLITE
TRANSIT 4A SATELLITE	TRANSIT IVA SATELLITE
TRANSIT 4B SATELLITE	TRANSIT IVB SATELLITE
TRANSIT 5A SATELLITE	TRANSIT VA SATELLITE
TYPE 2 BURSTS	TYPE II BURST
TYPE 3 BURSTS	TYPE III BURST
TYPE 4 BURSTS	TYPE IV BURST
TYPE 5 BURSTS	TYPE V BURST
*CASTOR 2 ENGINE	CASTOR II ROCKET ENGINE
*DASSAULT MIRAGE 3 AIRCRAFT	DASSAULT MIRAGE III AIRCRAFT
*MARBORE 2 ENGINE	MARBORE II ENGINE
*STRATOSCOPE 1 TELESCOPE	STRATOSCOPE I TELESCOPE
*STRATOSCOPE 2 TELESCOPE	STRATOSCOPE II TELESCOPE

THE GENITIVE

HOOKES LAW	HOOKE LAW
HUYGENS PRINCIPLE	HUYGEN PRINCIPLE
MILLS RATIO	MILL RATIO
PHILIPS IONIZATION GAGES	PHILLIP IONIZATION GAGE
SNELLS LAW	SNELL LAW
AIRY FUNCTION	AIRYS STRESS FUNCTION
*POCKELS EFFECT	POCKEL EFFECT
*YOUNG MODULUS	YOUNGS MODULUS

WORD DIVISION

AIR FLOW	AIRFLOW
AIR MAIL	AIRMAIL
AIRSPEED	AIR SPEED
AUDIO FREQUENCIES	AUDIOFREQUENCY
BANDPASS FILTERS	BAND PASS FILTER
CROSSLINKING	CROSS LINKING
EXPLORER SATELLITES	EXPLORER SATELLITE
FLASH POINT	FLASHPOINT
FLOWMETERS	FLOW METER
NATIONAL AIRSPACE UTILIZATION PROGRAM	NATIONAL AIR SPACE UTILIZATION PROGRAM
OPTICAL RANGE FINDERS	OPTICAL RANGEFINDER
PIPE FLOW	PIPEFLOW
PULSEJET ENGINES	PULSE JET ENGINE
RANGE FINDERS	RANGEFINDER
ROCK BOLTS	ROCKBOLT
WASPALOY	WASP ALLOY
*DEAD WEIGHT	DEADWEIGHT

HYPHENATION

ANALOG TO DIGITAL CONVERTERS	ANALOG-TO-DIGITAL CONVERTER
ALL SKY PHOTOGRAPHY	ALL-SKY PHOTOGRAPHY
BEACON EXPLORER A	BEACON EXPLORER-A
BEAM PLASMA AMPLIFIERS	BEAM-PLASMA AMPLIFIER
BINARY TO DECIMAL CONVERTERS	BINARY-TO-DECIMAL CONVERSION
BLUE GREEN ALGAE	BLUE-GREEN ALGAE
C BAND	C-BAND
DECIMAL TO BINARY CONVERTERS	DECIMAL-TO-BINARY CONVERSION
DHC 4 AIRCRAFT	DHC-4 AIRCRAFT
DHC 5 AIRCRAFT	DHC-5 AIRCRAFT
ELECTRON PHONON INTERACTIONS	ELECTRON-PHONON INTERACTION
FAN IN WING AIRCRAFT	FAN-IN-WING AIRCRAFT
FREQUENCY DIVISION MULTIPLEXING	FREQUENCY-DIVISION MULTIPLEXING
FREQUENCY SHIFT KEYING	FREQUENCY-SHIFT KEYING
GOLD 198	GOLD-198
H ALPHA LINE	H-ALPHA LINE
H BETA LINE	H-BETA LINE
H GAMMA LINE	H-GAMMA LINE
H LINES	H-LINE
HALF CONES	HALF-CONE
HALF LIFE	HALF-LIFE
LIQUID FILLED SHELLS	LIQUID-FILLED SHELL
M REGION	M-REGION

MAGNETO-OPTICS	MAGNETOOPTICS
MAN MACHINE SYSTEMS	MAN-MACHINE SYSTEM
MAP MATCHING GUIDANCE	MAP-MATCHING GUIDANCE
MOLTEN SALT ELECTROLYTES	MOLTEN SALT ELECTROLYTE
NICKEL CADMIUM BATTERIES	NICKEL-CADMIUM BATTERY
NICKEL ZINC BATTERIES	NICKEL-ZINC BATTERY
NONNEWTONIAN FLOW	NON-NEWTONIAN FLOW
NONNEWTONIAN FLUIDS	NON-NEWTONIAN FLUID
NUCLEAR ELECTRIC PROPULSION	NUCLEAR-ELECTRIC PROPULSION
O RING SEALS	O-RING SEAL
ONE DIMENSIONAL FLOW	ONE-DIMENSIONAL FLOW
PHASE SWITCHING INTERFEROMETERS	PHASE-SWITCHING INTERFEROMETER
PHASE SHIFT KEYING	PHASE-SHIFT KEYING
ROUND TRIP TRAJECTORIES	ROUND-TRIP TRAJECTORY
SA- 330 HELICOPTER	SA 330 HELICOPTER
SELF ABSORPTION	SELF-ABSORPTION
SELF ADAPTIVE CONTROL SYSTEMS	SELF-ADAPTIVE SYSTEM
SELF ALIGNMENT	SELF-ALIGNMENT
SELF FOCUSING	SELF-FOCUSING
SELF INDUCED VIBRATION	SELF-INDUCED VIBRATION
SELF LUBRICATING MATERIALS	SELF-LUBRICATING MATERIAL
SELF LUBRICATION	SELF-LUBRICATION
SELF OSCILLATION	SELF-OSCILLATION
SELF PROPAGATION	SELF-PROPAGATION

SELF REPAIRING DEVICES	SELF-REPAIRING SYSTEM
SELF SEALING	SELF-SEALING
SELF SUSTAINED EMISSION	SELF-SUSTAINED EMISSION
SILVER CADMIUM BATTERIES	SILVER-CADMIUM BATTERY
SILVER ZINC BATTERIES	SILVER-ZINC BATTERY
SLIP CASTING	SLIP-CASTING
SNAP 1	SNAP- 1
SNAP 2	SNAP- 2
SNAP 3	SNAP- 3
SNAP 7	SNAP- 7
SNAP 8	SNAP- 8
SNAP 9A	SNAP- 9A
SNAP 21	SNAP-21
SNAP 23	SNAP-23
SNAP 10A	SNAP-10A
SNAP 11	SNAP-11
SNAP 13	SNAP-13
SNAP 15	SNAP-15
SNAP 17	SNAP-17
SNAP 19	SNAP-19
TANDEM ROTOR HELICOPTERS	TANDEM-ROTOR HELICOPTER
THREE DIMENSIONAL BOUNDARY LAYER	THREE-DIMENSIONAL BOUNDARY LAYER
THREE DIMENSIONAL FLOW	THREE-DIMENSIONAL FLOW
TILT WING AIRCRAFT	TILT-WING AIRCRAFT

TSR-2 AIRCRAFT	TSR 2 AIRCRAFT
TWO DIMENSIONAL BODIES	TWO-DIMENSIONAL BODY
TWO DIMENSIONAL JETS	TWO-DIMENSIONAL JET
TWO DIMENSIONAL FLOW	TWO-DIMENSIONAL FLOW
TWO PHASE FLOW	TWO-PHASE FLOW
TWO REFLECTOR ANTENNAS	TWO-REFLECTOR ANTENNA
TWO STAGE PLASMA ENGINES	TWO-STAGE PLASMA ENGINE
TWO STAGE TURBINES	TWO-STAGE TURBINE
WING FUSELAGE STORES	WING-FUSELAGE-STORE
X RAYS	X-RAY
X RAY ABSORPTION	X-RAY ABSORPTION
X RAY ANALYSIS	X-RAY ANALYSIS
X RAY APPARATUS	X-RAY EQUIPMENT
X RAY ASTRONOMY	X-RAY ASTRONOMY
X RAY DENSITY MEASUREMENT	X-RAY DENSITY MEASUREMENT
X RAY DIFFRACTION	X-RAY DIFFRACTION
X RAY FLUORESCENCE	X-RAY FLUORESCENCE
X RAY INSPECTION	X-RAY INSPECTION
X RAY IRRADIATION	X-RAY IRRADIATION
X RAY SCATTERING	X-RAY SCATTERING
X RAY SPECTROSCOPY	X-RAY SPECTROSCOPY
X RAY TELESCOPES	X-RAY TELESCOPE

HYPHENATION: ACCESS ENTRIES

*BE A	BE-A
*BE B	BE-B
*BEACON EXPLORER B	BEACON EXPLORER-B
*CADMIUM SILVER BATTERIES	CADMIUM-SILVER BATTERY
*ZINC NICHEL BATTERIES	ZINC-NICHEL BATTERY
*K BAND	K-BAND
*KA BAND	KA-BAND
*KU BAND	KU-BAND
*L BAND	L-BAND
*MULTIPLE DEGREES OF FREEDOM	MULTIPLE-DEGREE-OF-FREEDOM
*PITOT STATIC TUBES	PITOT-STATIC TUBE
*PROJECTIVE DIFFERENTIAL GEOMETRY	PROJECTIVE-DIFFERENTIAL GEOMETRY
*S BAND	S-BAND
*SELF DIFFUSION	SELF-DIFFUSION
*SELF ERECTING ANTENNAS	SELF-ERECTING ANTENNA
*SELF REGULATING	SELF-REGULATING
*SINGLE SIDEBAND DEMODULATION	SINGLE-SIDEBAND DEMODULATION
*SINGLE SIDEBAND MODULATION	SINGLE-SIDEBAND MODULATION
*SINGLE SIDEBAND RECEIVERS	SINGLE-SIDEBAND RECEIVER
*TASK SEQUENCERS	TASK-SEQUENCER
*TELLURIC CURRENT MICROPULSATIONS	TELLURIC-CURRENT MICROPULSATION
*TWO PHASE SYSTEMS	TWO-PHASE SYSTEM
*V BAND	V-BAND
*X BAND	X-BAND
*X RAY PHOTOGRAPHY	X-RAY PHOTOGRAPHY
*X RAY SPECTROGRAPHY	X-RAY SPECTROGRAPHY
*X RAY SPECTROMETRY	X-RAY SPECTROMETRY
*X RAY TESTING	X-RAY TESTING

THE EFFECT OF THE CHANGE TO A NOUN FORM

ALBINISM	ALBINO
AMBIENCE	AMBIENT
BIMETALS	BIMETALLIC
CLEANLINESS	CLEAN
COMMERCE	COMMERCIAL
CRYSTALLINITY	CRYSTALLINE
FIDUCIARIES	FIDUCIAL
IONOSPHERICS	IONOSPHERIC
ISOMORPHISM	ISOMORPHOUS
ISOTONICITY	ISOTONIC
MAGNETOSTATICS	MAGNETOSTATIC
NONUNIFORMITY	NONUNIFORM
OPTIONS	OPTIONAL
ORTHOGONALITY	ORTHOGONAL
SKEWNESS	SKEW
SOFTNESS	SOFT
TRANSLUCENCE	TRANSLUCENT
TURBULENCE	TURBULENT
COUNTERSINKING	COUNTERSUNK
DEHUMIDIFICATION	DEHUMIDIFY
GYROSTABILIZERS	GYRO-STABILIZED

THE EFFECT OF THE CHANGE TO A NOUN FORM

*AMORPHOUSNESS	AMORPHOUS
*COMBUSTIBILITY	COMBUSTIBLE
*IMMISCIBILITY	IMMISCIBLE
*IMPERMEABILITY	IMPERMEABLE
*METAZOA	METAZOAN
*MISCIBILITY	MISCIBLE
*NONISOTROPY	NONISOTROPIC
*QUASILINEARITY	QUASI-LINEAR
*PULVERIZING	PULVERIZED

THE EFFECT OF THE USE OF THE "-ING" SUFFIX

ADDRESSING	ADDRESS
ASSAYING	ASSAY
BREAKING	BREAK
BULGING	BULGE
CHARRING	CHAR
CLOSING	CLOSE
COVERINGS	COVER
DEFROSTING	DEFROST
DEEP DRAWING	DEEP DRAW
DIPPING	DIP
DIMPLING	DIMPLE
DUMPING	DUMP
EMPTYING	EMPTY
EXCHANGING	EXCHANGE
FEATHERING	FEATHER
FIREPROOFING	FIREPROOF
FLUSHING	FLUSH
HAULING	HAUL
HEAT SHIELDING	HEAT SHIELD
HYDROSPINNING	HYDROSPIN
ION EXCHANGING	ION EXCHANGE
KALMAN-SCHMIDT FILTERING	KALMAN-SCHMIDT FILTER
LOFTING	LOFT

OPTICAL HETERODYNING	OPTICAL HETERODYNE
PIERCING	PIERCE
PURGING	PURGE
PUSHING	PUSH
RANDOM SAMPLING	RANDOM SAMPLE
RANKING	RANK
REENTRY SHIELDING	REENTRY SHIELD
RELEASING	RELEASE
RIGGING	RIG
RUPTURING	RUPTURE
RUSTING	RUST
SCARFING	SCARF
SEARCHING	SEARCH
SEQUENCING	SEQUENCE
SLEWING	SLEW
SLICING	SLICE
SOLAR HEATING	SOLAR HEAT
SOLAR RADIATION SHIELDING	SOLAR RADIATION SHIELD
SPIRAL WRAPPING	SPIRAL WRAP
SPREADING	SPREAD
STOPPING	STOP
STREAMLINING	STREAMLINE
SURFACE FINISHING	SURFACE FINISH
SWARMING	SWARM
SWIRLING	SWIRL

TEARING	TEAR
TESTING TIME	TEST TIME
TIME DIVISION MULTIPLEXING	TIME DIVISION MULTIPLEX
TWISTING	TWIST
UPSETTING	UPSET
VIEWING	VIEW
WIENER FILTERING	WIENER FILTER
WRINKLING	WRINKLE
CORDAGE	CORD
LINKAGES	LINK
RADIATION DOSAGE	RADIATION DOSE
WARPAGE	WARP
*CHILLING	CHILL
*COLD MOLDING	COLD MOLD
*FISHTAILING	FISHTAIL
*FLUTING	FLUTE
*INTERLOCKING	INTERLOCK
*JARRING	JAR
*PATCHING	PATCH
*PRESTRAINING	PRESTRAIN
*PUNCTURING	PUNCTURE
*RECYCLING	RECYCLE
*REMELTING	REMELT
*REPAIRING	REPAIR
*SQUEEZING	SQUEEZE
*TAPE MERGING	TAPE MERGE
*THAWING	THAW

THE EFFECT OF THE USE OF THE "-ING" SUFFIX

ANODIZING	ANODIZATION
CALIBRATING	CALIBRATION
CARBURIZING	CARBURIZATION
CENTRIFUGING	CENTRIFUGATION
COMPRESSING	COMPRESSION
CONCENTRATING	CONCENTRATION
CONDENSING	CONDENSATION
CORRUGATING	CORRUGATION
DELAMINATING	DELAMINATION
DEMINERALIZING	DEMINERALIZATION
DESENSITIZING	DESENSITIZATION
DESULFURIZING	DESULFURIZATION
DIGESTING	DIGESTION
DISRUPTING	DISRUPTION
DISTERMINATING	DISTERMINATION
ENCAPSULATING	ENCAPSULATION
ESTIMATING	ESTIMATION
EXHAUSTING	EXHAUSTION
EXTRUDING	EXTRUSION
FLOCCULATING	FLOCCULATION
IDENTIFYING	IDENTIFICATION
IMPREGNATING	IMPREGNATION

METALLIZING	METALLIZATION
NITRIDING	NITRIDATION
ORGANIZING	ORGANIZATION
PASTEURIZING	PASTEURIZATION
PERFORATING	PERFORATION
PERMEATING	PERMEATION
PRESERVING	PRESERVATION
PRESSURIZING	PRESSURIZATION
REFRIGERATING	REFRIGERATION
RETARDING	RETARDATION
SENSITIZING	SENSITIZATION
SILICONIZING	SILICONIZATION
VAPORIZING	VAPORIZATION
VULCANIZING	VULCANIZATION

*ALUMINIZING	ALUMINIZATION
*DEFLATING	DEFLATION
*DUPLICATING	DUPLICATION
*GALVANIZING	GALVANIZATION
*GAS EVACUATING	GAS EVACUATION
*HOT EXTRUDING	HOT EXTRUSION
*OBSTRUCTING	OBSTRUCTION
*TABULATING	TABULATION
*TERMINATING	TERMINATION

CHANGES BASED ON THE "USED FOR" STRUCTURE

DISTILLATION EQUIPMENT	DISTILLATION APPARATUS
LABORATORY EQUIPMENT	LABORATORY APPARATUS
MICROWAVE EQUIPMENT	MICROWAVE APPARATUS
PHOTOGRAPHIC EQUIPMENT	PHOTOGRAPHIC APPARATUS
FEEDBACK CONTROL	FEEDBACK CONTROL SYSTEM
ADAPTIVE CONTROL	ADAPTIVE CONTROL SYSTEM
PLASTIC AIRCRAFT STRUCTURES	PLASTIC AIRCRAFT CONSTRUCTION
STRESSED-SKIN STRUCTURES	STRESSED-SKIN CONSTRUCTION
AIRCRAFT STRUCTURES	AIRCRAFT CONSTRUCTION
MISSILE STRUCTURES	MISSILE CONSTRUCTION
SURFACE DIFFUSION	SURFACE DIFFUSION EFFECT
SHILLELAGH MISSILES	SHILLELAGH GUIDED MISSILE
SEACAT MISSILE	SEACAT GUIDED MISSILE
AIRCRAFT INSTRUMENTS	AIRCRAFT INSTRUMENTATION
SPACECRAFT INSTRUMENTS	SPACECRAFT INSTRUMENTATION
SATELLITE INSTRUMENTS	SATELLITE INSTRUMENTATION

GUN LAUNCHERS	GUN LAUNCHING DEVICE
ROCKET LAUNCHERS	ROCKET LAUNCHING DEVICE
ROCKET LININGS	ROCKET LINER
SHOCK MEASURING INSTRUMENTS	SHOCK MEASURING APPARATUS
COLD WEATHER TESTS	COLD WEATHER TESTING
COMPRESSION TESTS	COMPRESSION TESTING
DESTRUCTIVE TESTS	DESTRUCTIVE TESTING
ELECTRONIC EQUIPMENT TESTS	ELECTRONIC EQUIPMENT TESTING
ENGINE TESTS	ENGINE TESTING
ENVIRONMENTAL TESTS	ENVIRONMENTAL TESTING
FUEL TESTS	FUEL TESTING
HIGH ALTITUDE TESTS	HIGH ALTITUDE TESTING
MATERIALS TESTS	MATERIAL TESTING
NONDESTRUCTIVE TESTS	NONDESTRUCTIVE TESTING
PRELAUNCH TESTS	PRELAUNCH TESTING
PSYCHOLOGICAL TESTS	PSYCHOLOGICAL TESTING
STATIC TESTS	STATIC TESTING
ULTRASONIC TESTS	ULTRASONIC TESTING
VIBRATION TESTS	VIBRATION TESTING
MISSILE TEST LABORATORIES	MISSILE TESTING LABORATORY
*ENVIRONMENTAL TESTS	ENVIRONMENTAL TESTING
*FULL SCALE FATIGUE TESTS	FULL SCALE FATIGUE TESTING

METEOROID SHOWERS	METEOR SHOWER
METEOROID DUST CLOUDS	METEOR DUST CLOUD
PRIMARY COSMIC RAYS	PRIMARY COSMIC RADIATION
INCIDENT RADIATION	INCIDENT RAY
REFRACTORY METAL ALLOYS	REFRACTORY ALLOY
MERCURY LAMPS	MERCURY LIGHT
XENON LAMPS	XENON LIGHT
VACUUM APPARATUS	VACUUM EQUIPMENT
PRESSURE SUITS	PRESSURIZED SUIT
THERMAL STABILITY	THERMOSTABILITY
THERMAL CONDUCTIVITY	THERMOCONDUCTIVITY
THERMAL CONDUCTIVITY GAGES	THERMOCONDUCTIVITY GAUGE
CHEMICAL AUXILIARY POWER UNITS	CHEMICAL AUXILIARY POWER SOURCE
SOLAR AUXILIARY POWER UNITS	SOLAR AUXILIARY POWER SOURCE

GYRODYNE AIRCRAFT	GYRODYNE MILITARY AIRCRAFT
F 1 REGION	F- 1 LAYER
F 2 REGION	F- 2 LAYER
BETA PARTICLES	BETA RADIATION
SPACECRAFT CABINS	SPACE CABIN
SPACECRAFT CABIN SIMULATORS	SPACE CABIN SIMULATOR
COUPLING CIRCUITS	COUPLING NETWORK
RL CIRCUITS	RL NETWORK
TENSILE PROPERTIES	TENSILITY
HYDROGEN OXYGEN FUEL CELLS	HYDROX FUEL CELL
BROWNIAN MOVEMENTS	BROWNIAN MOTION
ENERGY OF FORMATION	FORMATION ENERGY
HEAT OF SOLUTION	SOLUTION HEAT

INSTRUMENT: PROCESS RELATIONSHIPS

NEUTRON SPECTROMETERS	NEUTRON SPECTROMETRY
SOLAR SPECTROMETERS	SOLAR SPECTROGRAPH
PSYCHROMETERS	PSYCHROMETRY
ULTRAVIOLET SPECTROPHOTOMETERS	ULTRAVIOLET SPECTROPHOTOMETRY
MICROWAVE REFLECTOMETERS	MICROWAVE REFLECTOMETRY
OPTOMETRY	OPTOMETER
GAS ANALYSIS	GAS ANALYZER
AMPLITUDE DISTRIBUTION ANALYSIS	AMPLITUDE DISTRIBUTION ANALYZER
FREQUENCY ANALYZERS	FREQUENCY ANALYSIS
RADIOACTIVE CONTAMINANTS	RADIOACTIVE CONTAMINATION
IMAGE CORRELATORS	IMAGE CORRELATION
RADAR DETECTION	RADAR DETECTOR
MAGNETIC DIFFUSION	MAGNETIC DIFFUSER
LIGHT MODULATION	LIGHT MODULATOR
MECHANICAL OSCILLATIONS	MECHANICAL OSCILLATOR
CONTROL SIMULATION	CONTROL SIMULATOR
EXHAUST FLOW SIMULATION	EXHAUST SIMULATOR
TARGET SIMULATORS	TARGET SIMULATION
ECHO SUPPRESSORS	ECHO SUPPRESSION

*AUTOCOLLIMATORS	AUTOCOLLIMATION
*DISPATCHING	DISPATCHER
*FREQUENCY REGULATION	FREQUENCY REGULATOR
*RADAR REFLECTIONS	RADAR REFLECTOR

RECURRING PATTERNS

BLAST LOADS	BLAST LOADING
COMPRESSION LOADS	COMPRESSION LOADING
STATIC LOADS	STATIC LOADING
THRUST LOADS	THRUST LOADING
VIBRATORY LOADS	VIBRATORY LOADING
SPOT WELDS	SPOT WELDING
*MOLECULAR BONDS	MOLECULAR BONDING
ELECTRICAL GROUNDING	ELECTRIC GROUNDING
ELECTRICAL IMPEDANCE	ELECTRIC IMPEDANCE
ELECTRICAL INSULATION	ELECTRIC INSULATION
ELECTRICAL MEASUREMENT	ELECTRIC MEASUREMENT
ELECTRICAL PROPERTIES	ELECTRIC PROPERTY
ELECTRICAL RESISTANCE	ELECTRIC RESISTANCE
*ELECTRICAL BREAKDOWN	ELECTRIC BREAKDOWN
*ELECTRICAL CONDUCTIVITY	ELECTRIC CONDUCTIVITY
*ELECTRICAL ENERGY	ELECTRIC ENERGY
IONIC MOBILITY	ION MOBILITY
ION PROPULSION	IONIC PROPULSION
ATMOSPHERIC MODELS	ATMOSPHERE MODEL
ERROR DETECTION CODES	ERROR DETECTING CODE

EXPERIMENTAL DESIGN	EXPERIMENT DESIGN
LOGIC DESIGN	LOGICAL DESIGN
PARABOLOID MIRRORS	PARABOLOIDAL MIRROR
PHENOLIC RESINS	PHENOL RESIN
SYNOPTIC MEASUREMENT	SYNOPTICAL MEASUREMENT

*PLANET ORIGINS	PLANETARY ORIGINS
*MAXWELLIAN DISTRIBUTION (DENSITY)	MAXWELL DISTRIBUTION
*TOWED TARGETS	TOW TARGET

UNCATEGORIZED DIFFERENCES

ABLATIVE NOSE CONES	ABLATING NOSE CONE
ABLATIVE MATERIALS	ABLATING MATERIAL
ANTIINFECTIVES AND ANTIBACTERIALS	ANTIBACTERIALS
AUSTENITIC STAINLESS STEELS	AUSTENITIC STEEL
MARTENSITIC STAINLESS STEELS	MARTENSITIC STEEL
AUTOCLAVING	AUTOCLAVE PROCESS
BITUMENS	BITUMINOUS MATERIAL
BODY-WING AND TAIL CONFIGURATIONS	BODY-WING AND TAIL COMBINATION
CHEMICAL AUXILIARY POWER UNITS	CHEMICAL AUXILIARY POWER SOURCE
SOLAR AUXILIARY POWER UNITS	SOLAR AUXILIARY POWER SOURCE
COMMUNICATION SATELLITES	COMMUNICATIONS SATELLITE
CRYSTAL DEFECTS	CRYSTAL STRUCTURE DEFECT
CUPOLAS	CUPULA
DISTRIBUTED AMPLIFIERS	DISTRIBUTED EMISSION AMPLIFIER
EARTH-MARS TRAJECTORIES	EARTH-MARS RENDEZVOUS TRAJECTORY
ELECTROSTATIC CHARGE	ELECTROSTATIC CHARGING
EVAPORATIVE COOLING	EVAPORATION COOLING
GROUND BASED CONTROL	GROUND CONTROL
HUMAN FACTORS LABORATORIES	HUMAN FACTOR LABORATORY
HYDROFORMING	HYDROFORM PROCESS
INCENDIARY AMMUNITION	INCENDIARY WEAPON
INERTIALESS STEERABLE ANTENNAS	INERTIALESS STEERABLE COMMUNICATIONS ANT
JODRELL BANK OBSERVATORY	JODRELL BANK

THE USE OF "SYSTEM"

AUTOMATIC LANDING CONTROL	AUTOMATIC LANDING SYSTEM
DIGITAL NAVIGATION	DIGITAL NAVIGATION SYSTEM
FUEL TANK PRESSURIZATION	FUEL TANK PRESSURIZATION SYSTEM
GAS COOLING	GAS COOLING SYSTEM
INERTIAL COORDINATES	INERTIAL COORDINATE SYSTEM
MONOPOLE ANTENNAS	MONOPOLE ANTENNA SYSTEM
PULSE DOPPLER RADAR	PULSED DOPPLER SYSTEM
SCHUMANN-RUNGE BANDS	SCHUMANN-RUNGE SYSTEM
SYMBOLIC PROGRAMMING	SYMBOLIC PROGRAMMING SYSTEM /SPS/
TRAJECTORY MEASUREMENT	TRAJECTORY MEASURING SYSTEM
VOICE DATA PROCESSING	VOICE DATA PROCESSING SYSTEM

RADIO RELAY SYSTEMS	RADIO RELAY
*AUTOMATIC DATA PROCESSING	AUTOMATIC DATA PROCESSING SYSTEM
*DIGITAL COMMUNICATION	DIGITAL COMMUNICATIONS SYSTEM
*FREQUENCY TRANSLATION	FREQUENCY TRANSLATION SYSTEM
*RAPID AUTOMATIC MALFUNCTION ISOLATION	RAPID AUTOMATIC MALFUNCTION ISOLATION SYSTEM
*REFLECTOR SATELLITES	REFLECTOR SATELLITE SYSTEM

LIGHT SPEED	LIGHT, SPEED OF
LIQUEFIED GASES	LIQUID GAS
LONG TERM EFFECTS	LONG PERIOD EFFECT
MONOMOLECULAR FILMS	MONOMOLECULAR LAYER
NICKEL PLATE	NICKEL PLATING
OPERATING TEMPERATURE	OPERATIVE TEMPERATURE
PERSONALITY TESTS	PERSONALITY ASSESSMENT
PULSE GENERATORS	PULSED GENERATOR
SIMILARITY THEOREM	SIMILARITY HYPOTHESIS
SIMULTANEOUS EQUATIONS	SIMULTANEOUS LINEAR EQUATION
SPARK MACHINING	SPARK EROSION MACHINING
SPOT WELDS	SPOT WELDING
TOXINS AND ANTITOXINS	TOXIN
ZODIACAL DUST	ZODIACAL DUST CLOUD

*RADIOACTIVE FALLOUT PARTICLES	RADIOACTIVE FALLOUT
*REACTION JET ATTITUDE CONTROL	REACTION JET ATTITUDE CONTROL TECHNIQUE
*VAN ALLEN RADIATION BELTS	VAN ALLEN BELT
*DELTA DAGGER AIRCRAFT	DELTA DAGGER
*DELTA DART AIRCRAFT	DELTA DART

THE USE OF PROP WORDS

CRITICAL PATH METHOD	CRITICAL PATH ANALYSIS
EXTRAVEHICULAR ACTIVITY	EXTRAVEHICULAR OPERATION
FINITE DIFFERENCE THEORY	FINITE DIFFERENCE METHOD
ELECTRONIC RECORDING SYSTEMS	ELECTRONIC RECORDING INSTRUMENT
REFRIGERATING MACHINERY	REFRIGERATING EQUIPMENT
TIMING DEVICES	TIMING APPARATUS
MICROMINIATURIZED ELECTRONIC DEVICES	MICROMINIATURIZED ELECTRONIC EQUIPMENT
POSITIONING DEVICES (MACHINERY)	POSITIONING EQUIPMENT
ENGINE MONITORING INSTRUMENTS	ENGINE MONITORING SYSTEM
TRACKING NETWORKS	TRACKING SYSTEM
BRAVAIS CRYSTALS	BRAVAIS LATTICE
CZOCHRAISKI METHOD	CZOCHRAISKI APPARATUS
DUFFING DIFFERENTIAL EQUATION	DUFFING EQUATION
FRANCK-CONDON PRINCIPLE	FRANCK-CONDON FACTOR
GIBBS ADSORPTION EQUATION	GIBBS EQUATION
VERNEUIL PROCESS	VERNEUIL TECHNIQUE
WEIBULL DENSITY FUNCTIONS	WEIBULL DISTRIBUTION
WIDMANSTATTEN STRUCTURE	WIDMANSTATTEN PATTERN

NOUN:NOUN RELATIONSHIPS

ALLOTROPY	ALLOTROPISM
FERROELECTRICITY	FERROELECTRICS
MACHINERY	MACHINE
TURBOMACHINERY	TURBOMACHINE
MEDICAL SCIENCE	MEDICINE
MICROTOMY	MICROTOME
PHOTOCHROMISM	PHOTOCHROMY
RADIOTELEPHONES	RADIOTELEPHONY
RESILIENCE	RESILIENCY
TIME DEPENDENCE	TIME DEPENDENCY

*DISCOVERING	DISCOVERY
*ENLARGING	ENLARGEMENT
*VALIDATION	VALIDITY
*POSTULATES	POSTULATION

ROCKETS, ENGINES AND MISSILES

AJ- 10 ENGINE	AJ- 10 ROCKET ENGINE
ALGOL ENGINE	ALGOL ROCKET ENGINE
BE-3 ENGINE	BE-3 ROCKET ENGINE
BRISTOL-SIDDELEY BS 53 ENGINE	BRISTOL-SIDDELEY BS-53 TURBOFAN ENGINE
BRISTOL-SIDDELEY MK 301 ENGINE	BRISTOL-SIDDELEY MK-301 ROCKET ENGINE
BRISTOL-SIDDELEY OLYMPUS 593 ENGINE	BRISTOL-SIDDELEY OLYMPUS 593 TURBOJET EN
BRISTOL-SIDDELEY VIPER ENGINE	BRISTOL-SIDDELEY VIPER TURBOJET ENGINE
CF-700 ENGINE	CF-700 TURBOFAN ENGINE
HERCULES ENGINE	HERCULES ROCKET ENGINE
H-1 ENGINE	H- 1 ROCKET ENGINE
J- 2 ENGINE	J- 2 ROCKET ENGINE
LR-59-AJ-13 ENGINE	LR59-AJ-13 ENGINE
LR-62-RM-2 ENGINE	LR62-RM-2 ROCKET ENGINE
LR-87-AJ-3 ENGINE	LR87-AJ-3 ROCKET ENGINE
LR-91-AJ-3 ENGINE	LR91-AJ-3 ROCKET ENGINE
LR-99 ENGINE	LR99 ROCKET ENGINE
M-57 ENGINE	M- 57 ROCKET ENGINE
MA- 2 ENGINE	MA-2 ROCKET ENGINE
MA- 3 ENGINE	MA-3 ROCKET ENGINE
MA- 5 ENGINE	MA-5 ROCKET ENGINE
MG-18 ENGINE	MG-18 ROCKET ENGINE
M- 1 ENGINE	M- 1 ROCKET ENGINE
M-46 ENGINE	M- 46 ROCKET ENGINE

M-55 ENGINE	M- 55 ROCKET ENGINE
M-56 ENGINE	M- 56 ROCKET ENGINE
P-1 ENGINE	P- 1 ROCKET ENGINE
PTL-6 ENGINE	PTL-6 GAS TURBINE ENGINE
RA-28 ENGINE	RA 28 JET ENGINE
RL-10-A-1 ENGINE	RL-10 A-1 ROCKET ENGINE
RL-10-A-3 ENGINE	RL-10 A-3 ROCKET ENGINE
RL-10 ENGINE	RL-10 ROCKET ENGINE
SUSTAINER ROCKET ENGINES	SUSTAINER ENGINE
SYNCOM APOGEE ENGINES	SYNCOM APOGEE ROCKET ENGINE
TE-289 ENGINE	TE-289 ROCKET ENGINE
TE-385 ENGINE	TE-385 ROCKET ENGINE
TF-106 ENGINE	TF 106 AIRCRAFT ENGINE
TU-121 ENGINE	TU-121 ROCKET ENGINE
TU-122 ENGINE	TU-122 MOTOR
TX- 77 ENGINE	TX- 77 ROCKET ENGINE
TX-135 ENGINE	TX-135 ROCKET ENGINE
TX-354 ENGINE	TX-354 ROCKET ENGINE
X-235 ENGINE	X-235 ROCKET ENGINE
X-248 ENGINE	X-248 ROCKET ENGINE
X-254 ENGINE	X-254 ROCKET ENGINE
X-258 ENGINE	X-258 ROCKET ENGINE
X-259 ENGINE	X-259 ROCKET ENGINE
X-405 ENGINE	X-405 ROCKET ENGINE

XLR- 58 ENGINE	XLR- 58 ROCKET ENGINE
XLR- 81-BA-13 ENGINE	XLR- 81-BA-13 ROCKET ENGINE
XLR- 99 ENGINE	XLR- 99 ROCKET ENGINE
XM-33 ENGINE	XM-33 ROCKET ENGINE
XT-761 ENGINE	XT-761 ARC JET ENGINE
YLR- 91-AJ-1 ENGINE	YLR 91-AJ-1 ROCKET ENGINE
YLR-101-NA-13 ENGINE	YLR-101-NA-13 ROCKET ENGINE
YLR-101-NA-15 ENGINE	YLR-101-NA-15 ROCKET ENGINE
YLR-115 ENGINE	YLR115 ROCKET ENGINE
*AJ-1000 ENGINE	AJ-1000 ROCKET ENGINE
*TX-33-39 ENGINE	TX 33-39 ROCKET ENGINE
*XJ-34-WE-32 ENGINE	XJ34-WE-32 TURBOJET ENGINE
*XJ-79-GE-1 ENGINE	XJ79-GE-1 TURBOJET ENGINE
*XLR- 91-AJ-5 ENGINE	XLR-91-AJ-5 ROCKET ENGINE
*XLR-115 ENGINE	XLR115 ROCKET ENGINE
*XV- 5A AIRCRAFT	XV-5A ROCKET AIRCRAFT
*YJ-73-GE-3 ENGINE	YJ73-GE-3 TURBOJET ENGINE
*YJ-79 ENGINE	YJ-79 TURBOJET ENGINE
*YJ-85 ENGINE	YJ85 AIRCRAFT ENGINE
*YJ-93 ENGINE	YJ93 TURBOJET ENGINE
*YJ-93-GE-3 ENGINE	YJ93-GE-3 TURBOJET ENGINE
*YLR- 62 ENGINE	YLR62 ROCKET ENGINE
*BAC TSR-2 AIRCRAFT	BAC TSR 2 AIRCRAFT
*HAWKER P-1154 AIRCRAFT	HAWKER P 1154 AIRCRAFT
*HAWKER P-1127 AIRCRAFT	HAWKER P 1127 AIRCRAFT
*SHORT SC-1 AIRCRAFT	SHORT SC.1 AIRCRAFT

SPACING

F- 100 AIRCRAFT	F-100 AIRCRAFT
F- 101 AIRCRAFT	F-101 AIRCRAFT
F- 102 AIRCRAFT	F-102 AIRCRAFT
F- 104 AIRCRAFT	F-104 AIRCRAFT
F- 106 AIRCRAFT	F-106 AIRCRAFT
F- 111 AIRCRAFT	F-111 AIRCRAFT
F-1 ROCKET ENGINE	F- 1 ROCKET ENGINE
F- 4 AIRCRAFT	F- 4 AIRCRAFT
F- 5 AIRCRAFT	F- 5 AIRCRAFT
F- 8 AIRCRAFT	F- 8 AIRCRAFT
F- 28 HELICOPTER	F- 28 HELICOPTER
L-29 JET TRAINER	L- 29 JET TRAINER
ROCKET ENGINE 15KS-25000	ROCKET ENGINE 15KS-25000
ROCKET ENGINE 1KS-420	ROCKET ENGINE 1KS-420
ROCKET ENGINE 2KS-36250	ROCKET ENGINE 2KS-36250
ROCKET ENGINE 9KS-11000	ROCKET ENGINE 9KS-11000
SH- 3 HELICOPTER	SH-3 HELICOPTER
XV- 3 AIRCRAFT	XV-3 AIRCRAFT
XV- 4 AIRCRAFT	XV-4 AIRCRAFT
XV- 5 AIRCRAFT	XV-5 AIRCRAFT
XV- 8A AIRCRAFT	XV-8A AIRCRAFT
XV- 9A AIRCRAFT	XV-9A AIRCRAFT

*F- 110 AIRCRAFT	F-110 AIRCRAFT
*V- 3 AIRCRAFT	V-3 AIRCRAFT
*V- 4 AIRCRAFT	V-4 AIRCRAFT
*V- 5 AIRCRAFT	V-5 AIRCRAFT
*V- 9 AIRCRAFT	V-9 AIRCRAFT
*XV- 6A AIRCRAFT	XV-6A AIRCRAFT

MISSILES AND ROCKETS

V-1 MISSILE	V-1 ROCKET
V-2 MISSILE	V-2 ROCKET
SPARROW MISSILES	SPARROW ROCKET
NIKE-AJAX MISSILE	NIKE-AJAX ROCKET
NIKE-HERCULES MISSILE	NIKE-HERCULES ROCKET
NIKE-ZEUS MISSILE	NIKE-ZEUS ROCKET
NIKE MISSILES	NIKE ROCKET
*ZEUS MISSILE	ZEUS ROCKET

SATELLITES

*S- 16 SATELLITE	S-16
*S- 17 SATELLITE	S-17
*S- 18 SATELLITE	S-18
*S- 49 SATELLITE	S-49
*S- 50 SATELLITE	S-50
*S- 57 SATELLITE	S-57
*S- 66 SATELLITE	S-66

UNCATEGORIZED DIFFERENCES

HYPERGOLIC ROCKET PROPELLANTS	HYPERGOLIC PROPELLANT
CRYOGENIC ROCKET PROPELLANTS	CRYOGENIC PROPELLANT
RP-1 ROCKET PROPELLANTS	RP-1 ROCKET FUEL

ROCKET PLANES	ROCKET AIRCRAFT
SKYBOLT MISSILE	SKYBOLT VEHICLE
LOW VOLUME RAMJET ENGINES	LOW VOLUME RAMJET
LOW WING AIRCRAFT	LOW WING
NUCLEAR RAMJET ENGINES	NUCLEAR RAMJET
NUCLEAR ROCKET ENGINES	NUCLEAR ROCKET
RETROROCKET ENGINES	RETROROCKET
ULLAGE ROCKET ENGINES	ULLAGE ROCKET

GLOSSED TERMS

ACTIVITY (BIOLOGY)	ACTIVITY /BIOL/
ACTIVITY CYCLES (BIOLOGY)	ACTIVITY CYCLE /BIOL/
BODY MEASUREMENT (BIOLOGY)	BODY MEASUREMENT /BIOL/
BODY TEMPERATURE (NON-BIOLOGICAL)	BODY TEMPERATURE
BODY TEMPERATURE	BODY TEMPERATURE /BIOL/
CENSORED DATA (MATHEMATICS)	CENSORED DATA /MATH/
FATIGUE (BIOLOGY)	FATIGUE /BIOL/
FATIGUE (MATERIALS)	FATIGUE
INEQUALITIES	INEQUALITY /MATH/
JOINTS (JUNCTIONS)	JOINT
PLANTS (BOTANY)	PLANT /BIOL/
SKIN (ANATOMY)	SKIN /BIOL/
SKIN (STRUCTURAL MEMBER)	SKIN
SKIN TEMPERATURE (BIOLOGY)	SKIN TEMPERATURE /BIOL/
SKIN TEMPERATURE (NON-BIOLOGICAL)	SKIN TEMPERATURE
TOLERANCES (PHYSIOLOGY)	TOLERANCE /BIOL/
TOLERANCES (MECHANICS)	TOLERANCE
ACCELERATION (PHYSICS)	ACCELERATION
ANGLES (GEOMETRY)	ANGLE
CONTINUITY (MATHEMATICS)	CONTINUITY
DEMAND (ECONOMICS)	DEMAND
EYE (ANATOMY)	EYE

FIXED POINTS (MATHEMATICS)	FIXED POINT
JET STREAMS (METEOROLOGY)	JET STREAM
MECHANICS (PHYSICS)	MECHANICS
MEDIAN (STATISTICS)	MEDIAN
METAMORPHISM (GEOLOGY)	METAMORPHISM
MODE (STATISTICS)	MODE
PLASMAS %PHYSICS¤	PLASMA
PRINTERS (DATA PROCESSING)	PRINTER
RELAXATION METHOD (MATHEMATICS)	RELAXATION METHOD
SCRAMBLING (COMMUNICATION)	SCRAMBLING
SUPERPOSITION (MATHEMATICS)	SUPERPOSITION
TEMPER (METALLURGY)	TEMPER
VARIANCE (STATISTICS)	VARIANCE
WIND (METEOROLOGY)	WIND
WORDS (LANGUAGE)	WORD

GLOSSED BY INITIALISM

ADENOSINE DIPHOSPHATE (ADP)	ADENOSINE DIPHOSPHATE
ADENOSINE TRIPHOSPHATE (ATP)	ADENOSINE TRIPHOSPHATE /ATP/
ADVANCED VIDICON CAMERA SYSTEM (AVCS)	ADVANCED VIDICON CAMERA SYSTEM /AVCS/
AIRBORNE RANGE AND ORBIT DETERMINATION	AIRBORNE RANGE AND ORBIT DETERMINATION /
AIRPORT SURFACE DETECTION EQUIPMENT	AIRPORT SURFACE DETECTION EQUIPMENT /ASD
ALTERNATING CURRENT	ALTERNATING CURRENT /AC/
APPLICATIONS TECHNOLOGY SATELLITES	APPLICATIONS TECHNOLOGY SATELLITE /ATS/
ARITHMETIC AND LOGIC UNITS	ARITHMETIC AND LOGIC UNIT /ALU/
ASTEC SOLAR TURBOELECTRIC GENERATOR	ADVANCED SOLAR TURBOELECTRIC CONVERSION
AUTOMATIC FLIGHT CONTROL	AUTOMATIC FLIGHT CONTROL SYSTEM /AFCS/
AUTOMATIC PICTURE TRANSMISSION	AUTOMATIC PICTURE TRANSMISSION /APT/
BALLISTIC MISSILE EARLY WARNING SYSTEM	BALLISTIC MISSILE EARLY WARNING SYSTEM /
BODY CENTERED CUBIC LATTICES	BODY CENTERED CUBIC /BCC/ CRYSTAL
CENTRAL ELECTRONIC MANAGEMENT SYSTEM	CENTRAL ELECTRONIC MANAGEMENT SYSTEM /CE
CONTINUOUS WAVE RADAR	CONTINUOUS WAVE /CW/ RADAR
DEEP SPACE INSTRUMENTATION FACILITY	DEEP SPACE INSTRUMENTATION FACILITY /DSI
DEFENSE COMMUNICATIONS SYSTEM (DCS)	DEFENSE COMMUNICATIONS SYSTEM /DCS/
DIFFERENTIAL THERMAL ANALYSIS	DIFFERENTIAL THERMAL ANALYSIS /DAT/
DIGITAL TO VOICE TRANSLATORS	DIGITAL TO VOICE TRANSLATOR /DIVOT/
DIRECT CURRENT	DIRECT CURRENT /DC/
DOWNRANGE ANTIMISSILE MEASUREMENT PROG	DOWNRANGE ANTIMISSILE MEASUREMENT PROG
ETHYLENEDIAMINETETRAACETIC ACIDS	ETHYLENEDIAMINETETRAACETIC ACID /EDTA/
EXPERIMENTAL GAS COOLED REACTORS	EXPERIMENTAL GAS COOLED REACTOR /EGCR/

FACE CENTERED CUBIC LATTICES	FACE CENTERED CUBIC /FCC/ CRYSTAL
FEEDBACK FREQUENCY MODULATION	FEEDBACK FREQUENCY MODULATION /FBFM/
FIELD ARMY BALLISTIC MISSILE DEFENSE	FIELD ARMY BALLISTIC MISSILE DEFENSE SYS
FIELD EFFECT TRANSISTORS	FIELD EFFECT TRANSISTOR /FET/
FLEET BALLISTIC MISSILES	FLEET BALLISTIC MISSILE /FBM/ WEAPON SYS
FM/PM (MODULATION)	FM/PM SYSTEM
GAS COOLED REACTORS	GAS COOLED REACTOR /GCR/
GLOBAL TRACKING NETWORK	GLOTRAC#GLOBAL TRACKING NETWORK /GLOTRAC
GROUND OPERATIONAL SUPPORT SYSTEM	GROUND OPERATIONAL SUPPORT SYSTEM /GOSS/
HIGH ALT TARGET AND BACKGROUND MEASURE	HIGH ALTITUDE TARGET AND BACKGROUND ME
HIGH ALTITUDE NUCLEAR DETECTION	HIGH ALTITUDE NUCLEAR DETECTION STUDIES
HIGH ENERGY FUELS	HIGH ENERGY FUEL /HEF/
HIGH RESOLUTION COVERAGE ANTENNAS	HIGH RESOLUTION COVERAGE ANTENNA TECHNIQ
HYDRAZINE ENGINES	HYDRAZINE ENGINE /NIMPHE/
INSTRUMENT FLIGHT RULES	INSTRUMENT FLIGHT RULE /IFR/
INTEGRATED MISSION CONTROL CENTER	INTEGRATED MISSION CONTROL CENTER /IMCC/
INTERCONTINENTAL BALLISTIC MISSILES	INTERCONTINENTAL BALLISTIC MISSILE /ICBM
INTERMEDIATE RANGE BALLISTIC MISSILES	INTERMEDIATE RANGE BALLISTIC MISSILE /IR
INTERSCIENCE DATA EXCHANGE PROGRAM	INTERSCIENCE DATA EXCHANGE PROGRAM /IDEP
LAUNCH ESCAPE SYSTEMS	LAUNCH ESCAPE SYSTEM /LES/
LIQUID AIR CYCLE ENGINES	LIQUID AIR CYCLE ENGINE /LACE/
LIQUID METAL COOLED REACTORS	LIQUID METAL COOLED REACTOR /LMCR/
LIQUID OXYGEN	LIQUID OXYGEN /LOX/
LOGISTICS OVER THE SHORE (LOTS) CARRIER	LOGISTICS OVER THE SHORE /LOTS/ CARRIER
LOW OBSERVABLE REENTRY VEHICLE	LOW OBSERVABLE REENTRY VEHICLE /LORV/

LUNAR MOBILE LABORATORIES	LUNAR MOBILE LABORATORY /MOLAB/
LUNAR ROVING VEHICLES	LUNAR ROVING VEHICLE /LRV/
MANNED ORBITAL TELESCOPES	MANNED ORBITAL TELESCOPE /MOT/
MAN OPERATED PROPULSION SYSTEMS	MAN OPERATED PROPULSION SYSTEM /MOPS/
MATTS %SYSTEMS¤	MATTS
METAL OXIDE SEMICONDUCTORS	METAL OXIDE SEMICONDUCTOR /MOS/
MINIMUM VARIANCE ORBIT DETERMINATION	MINIMUM VARIANCE ORBIT DETERMINATION /MI
MINITRACK SYSTEM	MINITRACK
MOVING TARGET INDICATORS	MOVING TARGET INDICATOR /MTI/ RADAR
MULTIPLE BEAM INTERVAL SCANNERS	MULTIPLE BEAM INTERVAL SCANNER /MUBIS/
NORTH AMERICAN SEARCH AND RANGING RADAR	NORTH AMERICAN SEARCH AND RANGING RADAR
NUCLEAR ENGINE FOR ROCKET VEHICLES	NUCLEAR ENGINE FOR ROCKET VEHICLE /NERVA
PERT	PERT PROJECT
PHOTOELECTROMAGNETIC EFFECT	PHOTOELECTROMAGNETIC /PEM/ EFFECT
PLAN POSITION INDICATORS	PLAN POSITION INDICATOR /PPI/
POLYSTATION DOPPLER TRACKING SYSTEM	POLYSTATION DOPPLER /POLYDOP/TRACKING
PULSE AMPLITUDE MODULATION	PULSE AMPLITUDE MODULATION /PAM/
PULSE CODE MODULATION	PULSE CODE MODULATION /PCM/
PULSE DURATION MODULATION	PULSE DURATION MODULATION /PDM/
PULSE FREQUENCY MODULATION	PULSE FREQUENCY MODULATION /PFM/
PULSE POSITION MODULATION	PULSE POSITION MODULATION /PPM/
PULSE TIME MODULATION	PULSE TIME MODULATION /PTM/
RADAR APPROACH CONTROL	RADAR APPROACH CONTROL /RAPCON/
RADAR TARGET SCATTER SITE PROGRAM	RADAR TARGET SCATTER SITE /RATSCAT/ PROG

RAMIS (SYSTEM)	RAMIS SYSTEM
SELF CALIBRATING OMNIRANGE	SELF-CALIBRATING OMNIRANGE /SCORE/
SELF CONSISTENT FIELDS	SELF-CONSISTENT FIELD /SCF/
SHORAN	SHORAN DISTANCE
SILICON CONTROLLED RECTIFIERS	SILICON CONTROL RECTIFIER /SCR/
SITE DATA PROCESSORS	SITE DATA PROCESSOR /SDP/
SLAM SUPERSONIC LOW ALTITUDE MISSILE	SLAM MISSILE
SNAP	SNAP PROGRAM
SPACE DETECTION AND TRACKING SYSTEM	SPACE DETECTION AND TRACKING SYSTEM /SPA
SPACE ELECTRIC ROCKET TESTS	SPACE ELECTRIC ROCKET TEST /SERT/
SPACE POWER UNIT REACTORS	SPACE POWER UNIT REACTOR /SPUR/
SPINNING UNGUIDED ROCKET TRAJECTORY	SPINNING UNGUIDED ROCKET TRAJECTORY /SPU
STADAN (SATELLITE TRACKING NETWORK)	STADAN
SUDDEN ENHANCEMENT OF ATMOSPHERICS	SUDDEN ENHANCEMENT OF ATMOSPHERICS /SEA/
SUPERSONIC COMBUSTION RAMJET ENGINES	SUPERSONIC COMBUSTION RAMJET MISSILE /SC
SUPERSONIC COMMERCIAL AIR TRANSPORT	SUPERSONIC COMMERCIAL AIR TRANSPORT /SCA
THRUST VECTOR CONTROL	THRUST VECTOR CONTROL /TVC/
TRANSPONDER CONTROL GROUP	TRANSPONDER CONTROL GROUP /TCG/
ULTRASONIC LIGHT MODULATION	ULTRASONIC LIGHT MODULATOR /ULM/
YTTRIUM-ALUMINUM GARNET	YTTRIUM-ALUMINUM GARNET /YAG/
YTTRIUM-IRON GARNET	YTTRIUM-IRON GARNET /YIG/

*ADVANCED ORBITING SOLAR OBSERVATORY	ADVANCED ORBITING SOLAR OBSERVATORY /AOSO/
*AUTOMATIC ROCKET IMPACT PREDICTORS	AUTOMATIC ROCKET IMPACT PREDICTOR /ARIP/
*CYCLOTRIMETHYLENE TRINITRAMINE	CYCLOTRIMETHYLENE TRINITRAMINE /RDX/
*DATA ADAPTIVE EVALUATOR/MONITOR	DATA ADAPTIVE EVALUATOR AND MONITOR /DAEMO/
*ECCENTRIC GEOPHYSICAL OBSERVATORY	ECCENTRIC GEOPHYSICAL OBSERVATORY /EGO/
*ECCENTRIC ORBIT GEOPHYSICAL OBSERVATORY	ECCENTRIC ORBITING GEOPHYSICAL OBSERVATORY /EOGO/
*FLUORINE-LIQUID OXYGEN	FLUORINE-LIQUID OXYGEN /FLOX/
*GODDARD EXPERIMENTAL PACKAGE TELESCOPE	GODDARD EXPERIMENT PACKAGE /GEP/ TELESCOPE
*INTERNATIONAL PRACTICAL TEMPERATURE	INTERNATIONAL PRACTICAL TEMPERATURE SCALE /IPTS/
*LOCATION OF AIR TRAFFIC SATELLITES	LOCATION OF AIR TRAFFIC ENROUTE SATELLITE SYSTEM /LOCATES/
*LOW ALTITUDE SUPERSONIC VEHICLES	LOW ALTITUDE SUPERSONIC VEHICLE /LORV/
*MINITRACK OPTICAL TRACKING SYSTEM	MINITRACK OPTICAL TRACKING SYSTEM /MOTS/
*MODULATING RETRODIRECTIVE OPTICS	MODULATION INDUCING RETRODIRECTIVE OPTICAL SYSTEM /MIROS/
*ORBITING ASTRONOMICAL OBSERVATORY	ORBITING ASTRONOMICAL OBSERVATORY /OAO/
*ORBITING GEOPHYSICAL OBSERVATORY	ORBITING GEOPHYSICAL OBSERVATORY /OGO/
*ORBITING SOLAR OBSERVATORY	ORBITING SOLAR OBSERVATORY /OSO/
*PENTAERYTHRITOL TETRANITRATE	PENTAERYTHRITOL TETRANITRATE /PETN/
*POLAR ORBIT GEOPHYSICAL OBSERVATORY	POLAR ORBIT GEOPHYSICAL OBSERVATORY /POGO/
*PULSE WIDTH MODULATION	PULSE WIDTH MODULATION /PWM/
*RADAR ABSORBING MATERIALS	RADAR ABSORBING MATERIAL /RAM/
*RESEARCH TORPEDO CONFIGURATION	RESEARCH TORPEDO CONFIGURATION /RETORC/
*ROCKET ENGINE NOZZLE EJECTOR PROGRAM	ROCKET ENGINE NOZZLE EJECTOR /RENE/ PROGRAM
*SATELLITE TRACKING AND DATA ACQ NETWORK	SATELLITE TRACKING AND DATA ACQUISITION NETWORK /STADAN/
*SELF DEPLOYING SPACE STATIONS	SELF-DEPLOYING SPACE STATION /SDSS/
*SENSOR-AIRBORNE TERRAIN ANALYSIS	SENSOR FOR AIRBORNE TERRAIN ANALYSIS /SATAN/
*SIMULTANEOUS IMAGE CORRELATORS	SIMULTANEOUS IMAGE CORRELATION /SIMICOR/
*SUPERSONIC COMBUSTION RAMJET MISSILE	SUPERSONIC COMBUSTION RAMJET MISSILE /SCRAM/
*SYSTEMS FOR NUCLEAR AUXILIARY POWER	SYSTEM FOR NUCLEAR AUXILIARY POWER /SNAP/
*TACTICAL AIR NAVIGATION	TACTICAL AIR NAVIGATION /TACAN/
*TRINITROTRIAZO CYCLO HEXANE	TRINITRO-TRIAZOCYCLOHEXANE /RDX/
*TUNGSTEN INERT GAS WELDING	TUNGSTEN INERT GAS /TIG/ WELDING
*VERTICAL TAKEOFF AND LANDING	VERTICAL TAKEOFF AND LANDING /VTOL/

GLOSSED BY CONTEXT

ANCHORS (FASTENERS)	ANCHOR
ATTITUDE (INCLINATION)	ATTITUDE
BASINS (CONTAINERS)	BASIN
BUNKERS (FUELS)	BUNKER
BURNTHROUGH (FAILURE)	BURNTHROUGH
CASES (CONTAINERS)	CASE
CIRCULATORS (PHASE SHIFT CIRCUITS)	CIRCULATOR
CRACKING (FRACTURING)	CRACKING
DIRECTORS (ANTENNA ELEMENTS)	DIRECTOR
DISLOCATIONS (MATERIALS)	DISLOCATION
ELECTRON DENSITY (CONCENTRATION)	ELECTRON DENSITY
EVACUATING (VACUUM)	EVACUATION
FRACTURES (MATERIALS)	FRACTURE
GRAPHS (CHARTS)	GRAPH
GUARDS (SHIELDS)	GUARD
GUIDANCE (MOTION)	GUIDANCE
GUMS (SUBSTANCES)	GUM
HULLS (STRUCTURES)	HULL
ION TRAPS (INSTRUMENTATION)	ION TRAP
LEAD (METAL)	LEAD
LIGHT (VISIBLE RADIATION)	LIGHT
LOAD DISTRIBUTION (FORCES)	LOAD DISTRIBUTION
LOADS (FORCES)	LOAD

MORTARS (MATERIAL)	MORTAR
NODES (STANDING WAVES)	NODE
PILOTS (PERSOMNEL)	PILOT
PIPES (TUBING)	PIPE
POWDER (PARTICLES)	POWDER
RACETRACKS (PARTICLE ACCELERATORS)	RACETRACK
RATES (PER TIME)	RATE
ROTOR BLADES (TURBOMACHINERY)	ROTOR BLADE
SEALS (STOPPERS)	SEAL
SEAMS (JOINTS)	SEAM
SEMICONDUCTORS (MATERIALS)	SEMICONDUCTOR
SHAFTS (MACHINE ELEMENTS)	SHAFT
SHELLS (STRUCTURAL FORMS)	SHELL
SIZE (DIMENSIONS)	SIZE
SPONGES (MATERIALS)	SPONGE
SPRINGS (ELASTIC)	SPRING
STUDS (STRUCTURAL MEMBERS)	STUD
SUSPENSION SYSTEMS (VEHICLES)	SUSPENSION SYSTEM
TABLES (DATA)	TABLE
TANKS (CONTAINERS)	TANK
THRESHOLD DETECTORS (DOSIMETERS)	THRESHOLD DETECTOR
THRESHOLDS (PERCEPTION)	THRESHOLD
TRACKING (POSITION)	TRACKING
VACANCIES (CRYSTAL DEFECTS)	VACANCY
WHISKERS (SINGLE CRYSTALS)	WHISKER

GLOSSED TERMS

MERCURY (METAL)	MERCURY /METAL/
EARTH (PLANET)	EARTH
JUPITER (PLANET)	JUPITER /PLANET/
MARS (PLANET)	MARS /PLANET/
MERCURY (PLANET)	MERCURY /PLANET/
NEPTUNE (PLANET)	NEPTUNE
PLUTO (PLANET)	PLUTO /PLANET/
SATURN (PLANET)	SATURN /PLANET/
URANUS (PLANET)	URANUS
VENUS (PLANET)	VENUS

*ADDERS (CIRCUITS)	ADDER
*ATTRITION (MATERIALS)	ATTRITION
*CHOPPERS (ELECTRIC)	CHOPPER
*CHORUS (DAWN PHENOMENON)	CHORUS
*COMPLIANCE (ELASTICITY)	COMPLIANCE
*CONTACTS (ELECTRIC)	CONTACT
*DIRECTION FINDERS (RADIO)	DIRECTION FINDER
*DOPING (ADDITIVES)	DOPING
*DRYERS (EQUIPMENT)	DRYER
*EXITS (DOORS)	EXIT
*GAIN (AMPLIFICATION)	GAIN
*HIGH GRAVITY (ACCELERATION)	HIGH GRAVITY
*INLETS (DEVICES)	INLET
*LABELING (MARKING)	LABELLING
*LAG (DELAY)	LAG
*LETTERS (SYMBOLS)	LETTER
*LIFETIME (DURABILITY)	LIFETIME
*MATERIAL REMOVAL (MACHINING)	MATERIAL REMOVAL
*PLANTS (INDUSTRIES)	PLANT
*PROCESSORS (COMPUTERS)	PROCESSOR
*RECEPTACLES (CONTAINERS)	RECEPTACLE
*SEEDING (INOCULATION)	SEEDING
*SIGNS (SYMBOLS)	SIGN
*SILOS (MISSILE STORAGE)	SILO
*SOFTWARE (COMPUTERS)	SOFTWARE
*SOLAR PLASMA (RADIATION)	SOLAR PLASMA
*STAGING (ROCKETS)	STAGING
*TRANSIENTS (SURGES)	TRANSIENT
*TRUNKS (LINES)	TRUNK
*UMBRA (SHADOWS)	UMBRA
*VERIFICATION (PROVING)	VERIFICATION
*WASHOUT (RADIOACTIVITY)	WASHOUT

*AC (CURRENT)	AC
*ALU (COMPUTER COMPONENTS)	ALU
*ARIP (IMPACT PREDICTION)	ARIP
*AROD (RANGE-ORBIT DETERMINATION)	AROD
*ATS (SATELLITES)	ATS
*DAEMO (DATA ANALYSIS)	DAEMO
*DC (CURRENT)	DC
*DIVOT (VOICE TRANSLATORS)	DIVOT
*DSIF (INSTRUMENTATION FACILITY)	DSIF
*DTA (ANALYSIS)	DTA
*EGCR (REACTOR)	EGCR
*FBFM (MODULATION)	FBFM
*FBM (MISSILES)	FBM
*FET (TRANSISTORS)	FET
*GCR (REACTORS)	GCR
*GLOTRAC (TRACKING NETWORK)	GLOTRAC
*GOSS (SUPPORT SYSTEM)	GOSS
*HEF (HIGH ENERGY FUELS)	HEF
*ICBM (MISSILES)	ICBM
*IDEP (DATA EXCHANGE)	IDEP
*IFR (RULES)	IFR
*IMCC (CONTROL CENTER)	IMCC
*IRBM (MISSILES)	IRBM
*LES (ESCAPE SYSTEMS)	LES
*LMCR (REACTORS)	LMCR
*LOX (OXYGEN)	LOX
*LRV (VEHICLE)	LRV
*MUBIS (SCANNERS)	MUBIS
*MOS (SEMICONDUCTORS)	MOS
*MOT (ORBITAL TELESCOPES)	MOT
*MOTS (TRACKING SYSTEM)	MOTS
*MOPS (PROPULSION SYSTEM)	MOPS
*NERVA (ENGINE)	NERVA
*NIMPHE (ENGINE)	NIMPHE
*PAM (MODULATED)	PAM
*PCM (MODULATION)	PCM

*PDM (MODULATION)	PDM
*PFM (MODULATION)	PFM
*PPI (POSITION INDICATORS)	PPI
*PPM (MODULATION)	PPM
*PTM (MODULATION)	PTM
*PWM (MODULATION)	PWM
*RAPCON (CONTROL)	RAPCON
*RETORC (TORPEDOES)	RETORC
*SATAN (SENSOR)	SATAN
*SIMICOR (IMAGE CORRELATOR)	SIMICOR
*SPURT (TRAJECTORY)	SPURT
*SDP (COMPUTERS)	SDP
*SCR (RECTIFIERS)	SCR
*TARE (DATA REDUCTION)	TARE
*TCG (TRACKING)	TCG
*TVC (CONTROL)	TVC
*ULM (LIGHT MODULATION)	ULM
*UHTREX (NUCLEAR REACTORS)	UHTREX
*YAG (GARNET)	YAG
*YIG (GARNET)	YIG
*MTI RADAR	MTI
*TIG WELDING	TIG

GLOSSED BY TRADEMARK

BAKELITE (TRADEMARK)	BAKELITE
CARBORUNDUM (TRADEMARK)	CARBORUNDUM
DACRON (TRADEMARK)	DACRON
DELRIN (TRADEMARK)	DELRIN
FORTISAN (TRADEMARK)	FORTISAN
HASTELLOY (TRADEMARK)	HASTELLOY
HOPCALITE (TRADEMARK)	HOPCALITE
INCONEL (TRADEMARK)	INCONEL
KOVAR (TRADEMARK)	KOVAR
LEXAN (TRADEMARK)	LEXAN
MANGANIN (TRADEMARK)	MANGANIN
MASONITE (TRADEMARK)	MASONITE
MONEL (TRADEMARK)	MONEL
MYLAR (TRADEMARK)	MYLAR
NICHROME (TRADEMARK)	NICHROME
PERMALLOYS (TRADEMARK)	PERMALLOY
PERSPEX (TRADEMARK)	PERSPEX
PYROCERAM (TRADEMARK)	PYROCERAM
SANTOWAX (TRADEMARK)	SANTOWAX
SKYDROL (TRADEMARK)	SKYDROL
STELLITE (TRADEMARK)	STELLITE
STYROFOAM (TRADEMARK)	STYROFOAM
TEFLON (TRADEMARK)	TEFLON

THIAZINE (TRADEMARK)	THIAZINE
VITON RUBBER (TRADEMARK)	VITON RUBBER
ZIRCALOYS (TRADEMARK)	ZIRCALOY
ZIRCALOY 2 (TRADEMARK)	ZIRCALOY 2
CARBAMATES (TRADENAME)	CARBAMATE

*AMPLITRONS (TRADEMARK)	AMPLITRON
*FLEXOWRITERS (TRADEMARK)	FLEXOWRITER
*GEON (TRADEMARK)	GEON
*LUCITE (TRADEMARK)	LUCITE
*MAGNESYN (TRADEMARK)	MAGNESYN
*PLEXIGLASS (TRADEMARK)	PLEXIGLASS
*PYREX (TRADEMARK)	PYREX
*REFRASIL (TRADEMARK)	REFRASIL
*SELSYNS (TRADEMARK)	SELSYN

UNMATCHED THESAURUS TERMS

THESAURUS TERM	SAL TERM
DISTRIBUTING	DISTRIBUTION
DISTRIBUTION	
DISTRIBUTION (PROPERTY)	
DISPERSING	DISPERSION
DISPERSION	
DISPERSIONS	
ILLUMINATING	ILLUMINATION
ILLUMINATION	
RETAINING	RETENTION
RETENTION	
RETENTION (PSYCHOLOGY)	
ASSEMBLIES	ASSEMBLY
ASSEMBLING	
ASSEMBLY	
BALANCE	BALANCE
BALANCING	
BUDGETING	BUDGET
BUDGETS	
CHIPPING	CHIP
CHIPS	
DRILLING	DRILL
DRILLS	
FLAKES	FLAKE
FLAKING	
FRACTURES (MATERIALS)	FRACTURE
FRACTURING	
GROOVES	GROOVE
GROOVING	
PITS	PIT
PITS (EXCAVATIONS)	
PITTING	
PLUGGING	PLUG
PLUGS	

SHEAR	SHEAR
SHEARING	
SHEARS	
VENTING	VENT
VENTS	

UNMATCHED, GLOSSED THESAURUS TERMS	GLOSSED BY FIELD
AGING (METALLURGY)	-AGING
ANALYSIS (MATHEMATICS)	-ANALYSIS
BEDS (PROCESS ENGINEERING)	-BED
CEILINGS (ARCHITECTURE)	-CEILING
COLUMNS (PROCESS ENGINEERING)	-COLUMN
CURVES (GEOMETRY)	-CURVE
DIAPHRAGMS (MECHANICS)	-DIAPHRAGM
DOMES (GEOLOGY)	-DOME
FIELD THEORY (PHYSICS)	-FIELD THEORY
FORMULAS (MATHEMATICS)	-FORMULA
FUNCTIONS (MATHEMATICS)	-FUNCTION
HEAD (FLUID MECHANICS)	-HEAD
HOLE DISTRIBUTION (ELECTRONICS)	-HOLE DISTRIBUTION
HOLE DISTRIBUTION (MECHANICS)	-HOLE DISTRIBUTION
INHIBITION (PSYCHOLOGY)	-INHIBITION
LATTICES (MATHEMATICS)	-LATTICE
MATRICES (MATHEMATICS)	-MATRIX
NORMALIZING (STATISTICS)	-NORMALIZATION
PRECIPITATION (CHEMISTRY)	-PRECIPITATION
PRECIPITATION (METEOROLOGY)	-PRECIPITATION
REDUCTION (CHEMISTRY)	-REDUCTION
REGENERATION (ENGINEERING)	-REGENERATION
RELAXATION (MECHANICS)	-RELAXATION
RHYTHM (BIOLOGY)	-RHYTHM

UNMATCHED, GLOSSED THESAURUS TERMS	GLOSSED BY CONTEXT
ABSORBERS (EQUIPMENT)	-ABSORBER
ABSORBERS (MATERIALS)	-ABSORBER
ACCUMULATORS (COMPUTERS)	-ACCUMULATOR
BALLAST (MASS)	-BALLAST
BALLASTS (IMPEDANCES)	-BALLAST
BARRELS (CONTAINERS)	-BARREL
BAYS (STRUCTURAL UNITS)	-BAYS
BEAMS (RADIATION)	-BEAM
BINDERS (MATERIALS)	-BINDER
BLACKOUT (PROPAGATION)	-BLACKOUT
BLADES (CUTTERS)	-BLADE
BLANKING (CUTTING)	-BLANKING
BOARDS (PAPER)	-BOARD
BOMBS (ORDNANCE)	-BOMB
BOXES (CONTAINERS)	-BOX
BRAKES (FORMING OR BENDING)	-BRAKE
BRIDGES (STRUCTURES)	-BRIDGE
BURNS (INJURIES)	-BURN
BUTTONS (FASTENERS)	-BUTTON
CABLES (ROPES)	-CABLE
CHOKES (RESTRICTIONS)	-CHOKE
COMPOSITION (PROPERTY)	-COMPOSITION
CONCENTRATION (COMPOSITION)	-CONCENTRATION

CONDENSERS (LIQUIFIERS)	-CONDENSER
DAMPERS (VALVES)	-DAMPER
DENSITY (MASS/VOLUME)	-DENSITY
DENSITY (NUMBER/VOLUME)	-DENSITY
DISKS (SHAPES)	-DISK
DISTRIBUTION (PROPERTY)	-DISTRIBUTION
DITCHING (LANDING)	-DITCH
DOMES (STRUCTURAL FORMS)	-DOME
DROPS (LIQUIDS)	-DROP
DRUMS (CONTAINERS)	-DRUM
ELEVATORS (LIFTS)	-ELEVATOR
ESCAPE (ABANDONMENT)	-ESCAPE
EVACUATING (TRANSPORTATION)	-EVACUATION
EVOLUTION (LIBERATION)	-EVOLUTION
FEEDING (SUPPLYING)	-FEED
FILES (TOOLS)	-FILE
FIRING (IGNITING)	-FIRING
FLASHING (VAPORIZING)	-FLASH
FLOUR (FOOD)	-FLOUR
FLUX (RATE)	-FLUX
FUSION (MELTING)	-FUSION
GATES (CIRCUITS)	-GATE
GATES (OPENINGS)	-GATE
GLANDS (SEALS)	-GLAND

GRINDING (COMMINUTION)	-GRINDING
GRINDING (MATERIAL REMOVAL)	-GRINDING
GUNS (ORDNANCE)	-GUN
HARDENING (MATERIALS)	-HARDENING
HARDENING (SYSTEMS)	-HARDENING
HOLES (ELECTRON DEFICIENCIES)	-HOLE
ISOBARS (PRESSURE)	-ISOBAR
LEVEL (QUANTITY)	-LEVEL
LIFE (DURABILITY)	-LIFE
LOCKS (FASTENERS)	-LOCK
MATRICES (CIRCUITS)	-MATRIX
MILLING (MACHINING)	-MILLING
MINES (EXCAVATIONS)	-MINE
NOISE (SOUND)	-NOISE
NORMALIZING (HEAT TREATMENT)	-NORMALIZATION
NUTS (FASTENERS)	-NUTS AND BOLTS
OPERATORS (PERSONNEL)	-OPERATOR
PACKINGS (SEALS)	-PACKING
PITS (EXCAVATIONS)	-PIT
PITCH (INCLINATION)	-PITCH
PLATES (STRUCTURAL MEMBERS)	-PLATE
POLARIZATION (CHARGE SEPARATION)	-POLARIZATION
POLARIZATION (WAVES)	-POLARIZATION
PORTS (OPENINGS)	-PORT

POSITION (LOCATION)	-POSITION
POSITION (TITLE)	-POSITION
POTENTIOMETERS (INSTRUMENTS)	-POTENTIOMETER
POTENTIOMETERS (RESISTORS)	-POTENTIOMETER
PRESSING (FORMING)	-PRESSING
PRIMERS (COATINGS)	-PRIMER
PROGRAMMING (SCHEDULING)	-PROGRAMMING
PROPAGATION (EXTENSION)	-PROPAGATION
QUENCHING (COOLING)	-QUENCHING
RACKS (GEARS)	-RACK
RAMS (PUMPS)	-RAM
RANGE (EXTREMES)	-RANGE
REGISTERS (AIR CIRCULATION)	-REGISTER
REINFORCEMENT (STRUCTURES)	-REINFORCEMENT
REPRODUCTION (COPYING)	-REPRODUCTION
RETARDERS (DEVICES)	-RETARDER
SCALE (CORROSION)	-SCALE
SCALE (RATIO)	-SCALE
SIZING (SHAPING)	-SIZING
SIZING (SURFACE TREATMENT)	-SIZING
SPACE SURVEILLANCE (GROUND BASED)	-SPACE SURVEILLANCE
SPACE SURVEILLANCE (SPACEBORNE)	-SPACE SURVEILLANCE
STABILIZERS (AGENTS)	-STABILIZER
STRIPPING (DISTILLATION)	-STRIPPING

THICKENERS (MATERIALS)	-THICKENER
TUNNELING (EXCAVATION)	-TUNNELING
UNIONS (CONNECTORS)	-UNION
WASHERS (CLEANERS)	-WASHER
WASHERS (SPACERS)	-WASHER
WEBS (SHEETS)	-WEB
WEBS (SUPPORTS)	-WEB
WEIGHT (MASS)	-WEIGHT
WINDOWS (APERTURES)	-WINDOW

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